CHAPTER 13

Databases and Information Management

Your Grand Canyon vacation ends tomorrow. As you relax by the fire in your cabin, you think about the spectacular views and natural wonders you experienced throughout the past two weeks. Then your thoughts drift to home and work and the dozens of e-mail and voice mail messages you likely have received.

That is only the beginning. The front and back lawns will need mowing, the laundry will be monumental, and the refrigerator is empty. Wait! You usually order groceries on the Web. Your cellular telephone is in your suitcase, which means you have wireless access to the Web. Why not go online and place your order right now? You immediately shop at your Web grocer and schedule a delivery for tomorrow night.

Online shopping no doubt has been a timesaver for you and millions of other shoppers worldwide. When ordering online, you access the retailer's huge inventory database. These databases store thousands of products. You certainly are grateful to the people who design those product databases for the Web. Now, you can relax again. At least you will have something to eat when you get home.

OBJECTIVES

After completing this chapter, you will be able to:

- Explain why data and information are important to an organization
- Identify file maintenance techniques
- Differentiate between the file processing and database approaches
- Discuss the advantages of using a database management system (DBMS)
- Describe characteristics of relational and object-oriented databases
- Explain how to use a query language
- Understand how Web databases work
- Discuss the responsibilities of the database analysts and administrators
- Identify the qualities of valuable information
- Describe the various types of information systems
- Understand the concept of a data warehouse

DATA AND INFORMATION

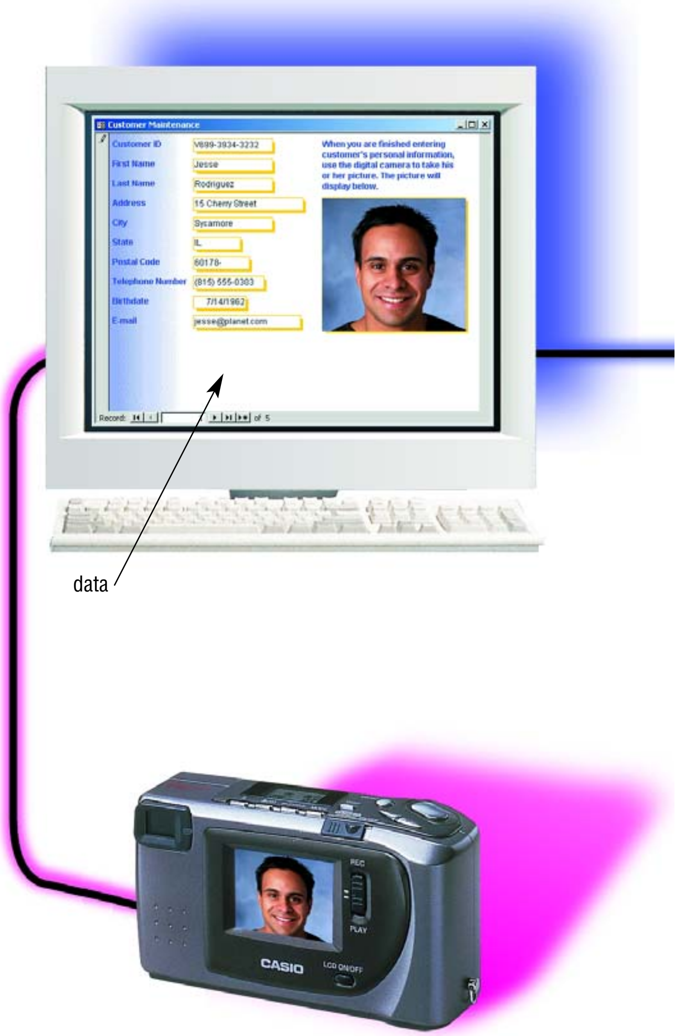
Data is a collection of raw unprocessed facts, figures, and symbols. In the past, data was limited to words and numbers. Today, data is much more interesting because it includes sounds, images, and video. For example, you can talk into a computer's microphone. A digital camera can send your pictures directly into the computer. You can attach a video camera to capture movements and sounds.

Information is data that is organized, meaningful, and useful. Your voice communication can be sent in an e-mail message for a friend or co-worker to hear. You can post a photograph from your digital camera on a personal Web page. Using a PC camera, others can view you in real-time during a conference call.

Computers process data into information. A computer in a video rental store, for example, processes customer and movie data and then prints information on a rental receipt. As shown in Figure 13-1, a clerk enters several data items into the computer. The clerk also uses a digital camera to photograph the customer. This picture, along with the other entered data, is stored in the database on disk.

As presented in Chapter 3, a **database** includes a collection of data organized so you can access, retrieve, and use the data. A database at a video rental store contains data about customers and movies.

With database software, also called a database management system (DBMS), you can create a computerized database; add, change, and delete data; sort and retrieve data from the database; and create forms and reports from the data in the database. A video rental store might use Microsoft Access as its DBMS. When a customer wishes to rent a movie, a checkout clerk enters the customer and movie data. Then, the database software creates and prints the rental receipt. Database software includes these and many other powerful features, as you will discover later in this chapter.



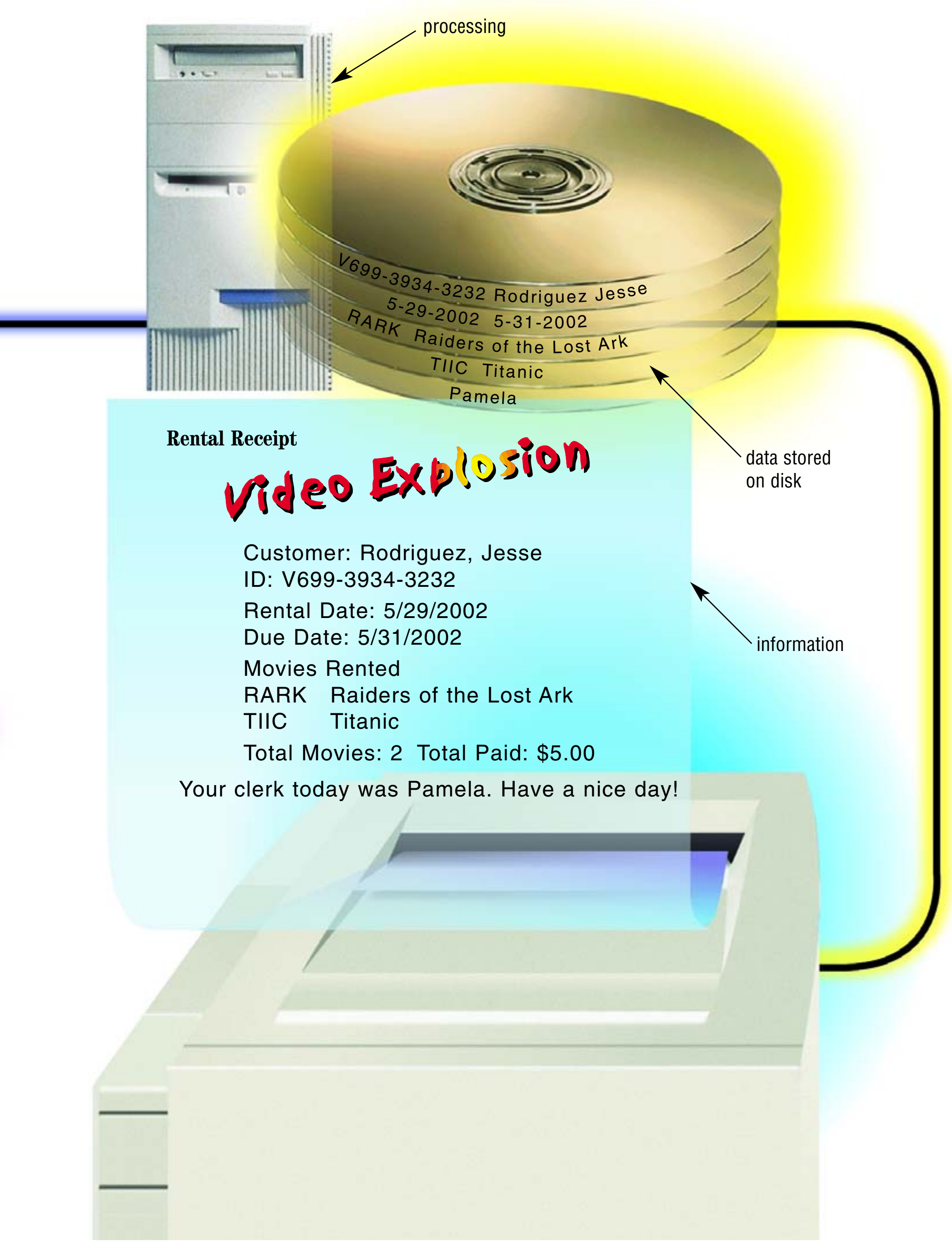
Customer ID V699-3934-3232
First Name Jesse
Last Name Rodriguez
Address 15 Cherry Street
City Sycamore
State IL
Postal Code 60178-
Telephone Number (815) 555-0303
Birthdate 7/14/1962
E-mail jesse@planet.com

When you are finished entering customer's personal information, use the digital camera to take his or her picture. The picture will display below.

Figure 13-1 A computer processes data into information. In this example, a clerk enters several data items into the computer. The clerk also uses a digital camera to take a picture of the customer.

Most companies realize that data is one of their more valuable assets. Many business transactions take less time when employees have instant access to data. If checkout clerks in a video rental store have instant access to movie rental data, they can determine which movies are in stock upon customer request. An increase in employee productivity often leads to an increase in customer satisfaction. When customers are happy, they typically become loyal to that business. Loyal customers can lead to an increase in profits.

Managers in a company make decisions using all types of information such as sales trends, competitors' products and services, production processes, and even employee skills. This information would be difficult, if not impossible, to replace. Because information is created from data, a company must manage and protect its data just as it would any other resource. It is extremely important the data has integrity and is kept secure. Chapter 12 presented a variety of methods to secure data. The next section discusses data integrity.



Rental Receipt

Video Explosion

Customer: Rodriguez, Jesse
ID: V699-3934-3232
Rental Date: 5/29/2002
Due Date: 5/31/2002
Movies Rented
RARK Raiders of the Lost Ark
TIIC Titanic
Total Movies: 2 Total Paid: $5.00
Your clerk today was Pamela. Have a nice day!

Data Integrity

For a computer to produce correct information, the data that is input into a database must have integrity. **Data integrity** is the degree to which data is correct. A misspelled movie title in a movie database is an example of incorrect data. When a database contains these types of errors, it loses integrity. The more errors the data contains, the less its integrity. Users will not rely on data that has little or no integrity.

Garbage in, garbage out (**GIGO** pronounced ghee-go) is a computer phrase that states you cannot create correct information from data that is incorrect. If you enter incorrect data into a computer (garbage in), the computer will produce incorrect information (garbage out). Correct data does not guarantee the information is correct, but it does increase the chances.

Data integrity is very important because computers and people use information to make decisions and take actions. When you order a product, such as a book about gardening, a process begins that eventually delivers you the book. Before you receive the book, the retailer usually charges the order to your credit card. The retailer will bill an incorrect amount to your credit card if the book's price is not correct in its database. This type of error causes both you and the retailer extra time and effort to remedy.

THE HIERARCHY OF DATA

Data is built in layers. In the computer field, data is classified in a hierarchy. Each higher level of data consists of one or more items from the prior level. For example, a customer has an address, and an address consists of letters and numbers. Depending on the application and the user, different terms describe the various levels of the hierarchy. While using database software, you will see one or more of these terms. Thus, it is important to understand their usages and meanings.

Commonly used terms are character, field, record, file, and database. As shown in Figure 13-2, a database contains files, a file contains records, a record contains fields, and a field is made up of characters. As discussed in Chapter 4, a bit is the smallest unit of data the computer can recognize. Eight bits grouped together in a unit comprise a byte. Each byte represents a single **character**, such as a number (4), letter (R), punctuation mark (?), or other symbol (&).

A **field** is a combination of one or more characters and is the smallest unit of data a user accesses. A **field name** uniquely identifies each field. When you search for data in a database, you enter the field name. Field names for the records in the Movie file are Movie ID, Title, and Rating.

A database uses a variety of characteristics, such as data type and

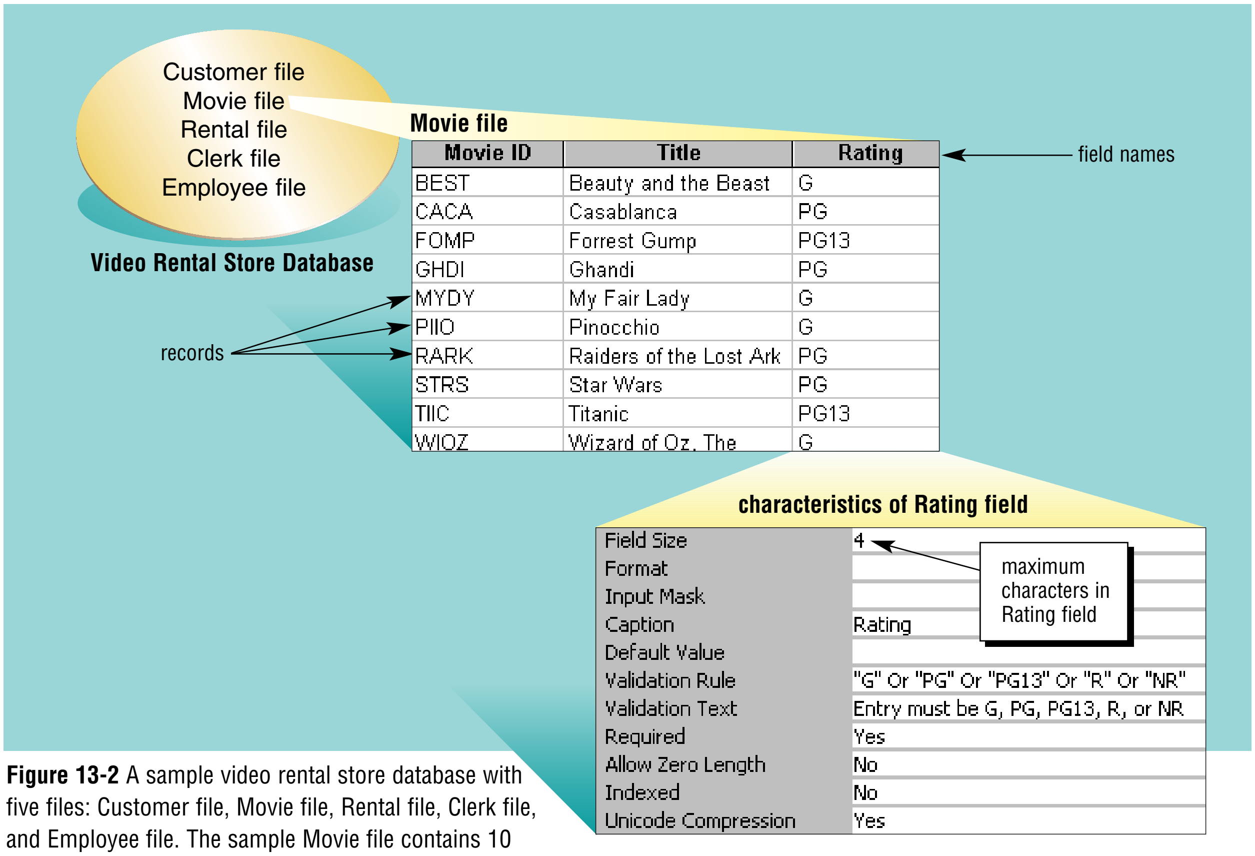


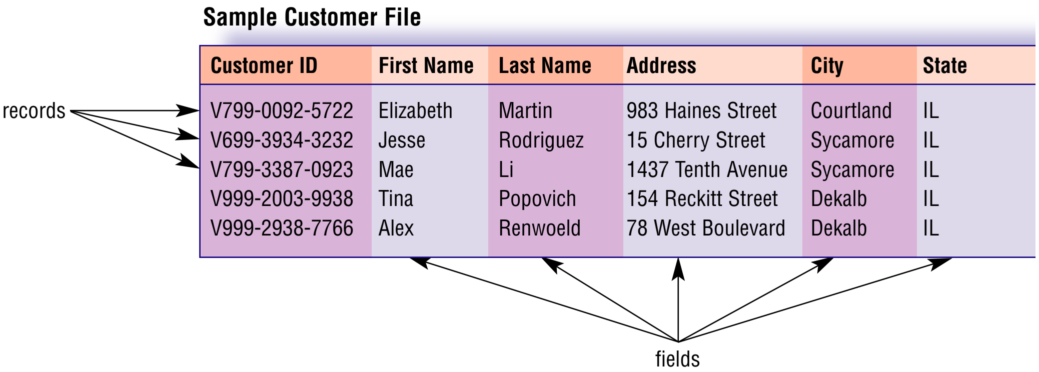
Figure 13-2 A sample video rental store database with five files: Customer file, Movie file, Rental file, Clerk file, and Employee file. The sample Movie file contains 10 records. Each record contains three fields. The Rating field can contain a maximum of four characters (bytes).

Movie file

Movie ID	Title	Rating
BEST	Beauty and the Beast	G
CACA	Casablanca	PG
FOMP	Forrest Gump	PG13
GHDI	Ghandi	PG
MYDY	My Fair Lady	G
PIIO	Pinocchio	G
RARK	Raiders of the Lost Ark	PG
STRS	Star Wars	PG
TIIC	Titanic	PG13
WIOZ	Wizard of Oz, The	G

characteristics of Rating field

Field Size	4
Format	
Input Mask	
Caption	Rating
Default Value	
Validation Rule	"G" Or "PG" Or "PG13" Or "R" Or "NR"
Validation Text	Entry must be G, PG, PG13, R, or NR
Required	Yes
Allow Zero Length	No
Indexed	No
Unicode Compression	Yes



Sample Customer File

Customer ID	First Name	Last Name	Address	City	State
V799-0092-5722	Elizabeth	Martin	983 Haines Street	Courtland	IL
V699-3934-3232	Jesse	Rodriguez	15 Cherry Street	Sycamore	IL
V799-3387-0923	Mae	Li	1437 Tenth Avenue	Sycamore	IL
V999-2003-9938	Tina	Popovich	154 Reckitt Street	Dekalb	IL
V999-2938-7766	Alex	Renwoeld	78 West Boulevard	Dekalb	IL

field size, to define each field. As described in Chapter 3, the **data type** specifies the kind of data a field can contain and how the field is used. Common data types include:

- **Text** – letters, numbers, or special characters
- **Numeric** – numbers only
- **Currency** – dollar and cent amounts or numbers containing decimal values
- **Date** – month, day, year, and sometimes time information
- **Memo** – lengthy text entries
- **Yes/No** – only the values Yes or No
- **Hyperlink** – Web address that links to a document or a Web page
- **Object** – picture, audio, video, or a document created in other applications such as word processing or spreadsheet

The **field size** defines the maximum number of characters a field can contain. A State field may contain the two-character postal code. A Rating field for a movie, by contrast, may contain up to four characters. Some movies have a G rating (one character), some have a PG rating (two characters), and some have a PG13 rating (four characters).

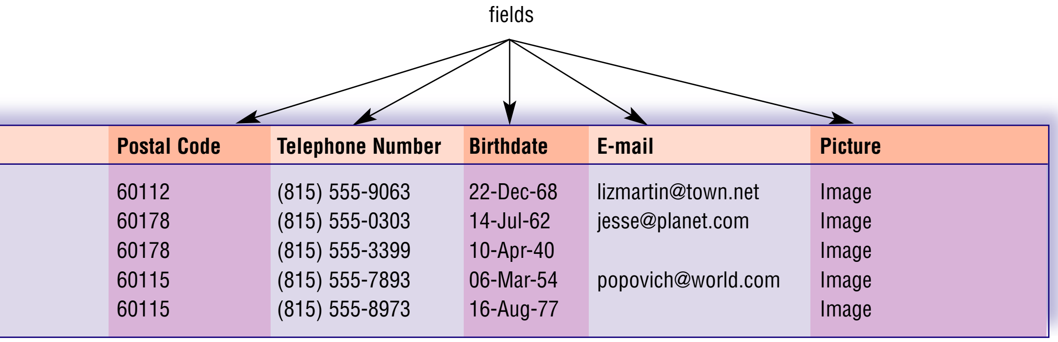
A **record** is a group of related fields. A movie record includes a set of fields about one movie. This record might contain field names such as Movie ID, Title, and Rating.

A **key field**, or **primary key**, is a field that uniquely identifies each record in a file. The data in a key field is unique to a specific record. For example, the Movie ID field uniquely identifies each movie because no two movies have the same Movie ID.

A **data file**, also often called a **file**, is a collection of related records stored on a disk such as a hard disk or CD-ROM. A video rental store's Customer file would consist of hundreds of individual customer records. Each customer record in the file contains the same fields. Each field, however, contains different data. Figure 13-3 shows a small sample Customer file that contains 5 customer records, each with 11 fields. Typical fields about people often include First Name, Last Name, Address, City, State, Postal Code, Telephone Number, and E-mail Address.

As defined in previous chapters, the term file also can refer to word processing, spreadsheet, or other executable application files. These types of files, sometimes known as **program files**, may or may not use data files.

A database includes a group of related data files. A video rental store's database, for example, might have many individual files such as a Customer file, a Movie file, and a Rental file. With a DBMS, you can access and relate the data in data files.



Postal Code	Telephone Number	Birthdate	E-mail	Picture
60112	(815) 555-9063	22-Dec-68	lizmartin@town.net	Image
60178	(815) 555-0303	14-Jul-62	jesse@planet.com	Image
60178	(815) 555-3399	10-Apr-40		Image
60115	(815) 555-7893	06-Mar-54	popovich@world.com	Image
60115	(815) 555-8973	16-Aug-77		Image

Figure 13-3 A sample data file stored on a hard disk that contains 5 records, each with 11 fields.

APPLY IT!

What's in a Home Inventory List?

Everyone should have a home inventory list of his or her possessions for insurance and personal use. A database program is the perfect tool for creating such a list.

Follow these instructions to plan your home inventory database:

1. Categorize your personal property into tables using meaningful names such as appliances, artwork, collectibles, china, electronics, furniture, jewelry, and silver.
2. Determine the fields within each table. Use the Text data type for the item name, manufacturer name, and location. Use the Currency data type for price and the Date data type for the purchase date. If you intend to add pictures, use the Object data type. You also may want to add a Memo field for notes.
3. For electronics and appliances, most likely you would use serial numbers or the model number for the primary key. For categories that may not have identifying numbers, you can number each item sequentially, or use your own unique combination of numbers and/or letters.

To create a home inventory database, you have several options. You can use a database program such as Microsoft Access. With this type of software, you can create reports and query your database. If you choose to use Access, you can download a Home Inventory template (see URL below). Modify the template to meet your personal needs and then add your data.

You also may use a spreadsheet program such as Microsoft Excel, which is easier and faster, though not as powerful as a database program. Using the Excel Help Answer Wizard, type `how do I manage lists` to view instructions on setting up your data.

Finally, use a software program designed specifically for home inventory purposes. Several free and shareware inventory programs are available online.

For more information on shareware and databases, visit the Discovering Computers 2002 Apply It Web page (**scsite.com/dc2002/apply.htm**) and click Chapter 13 Apply It #1.

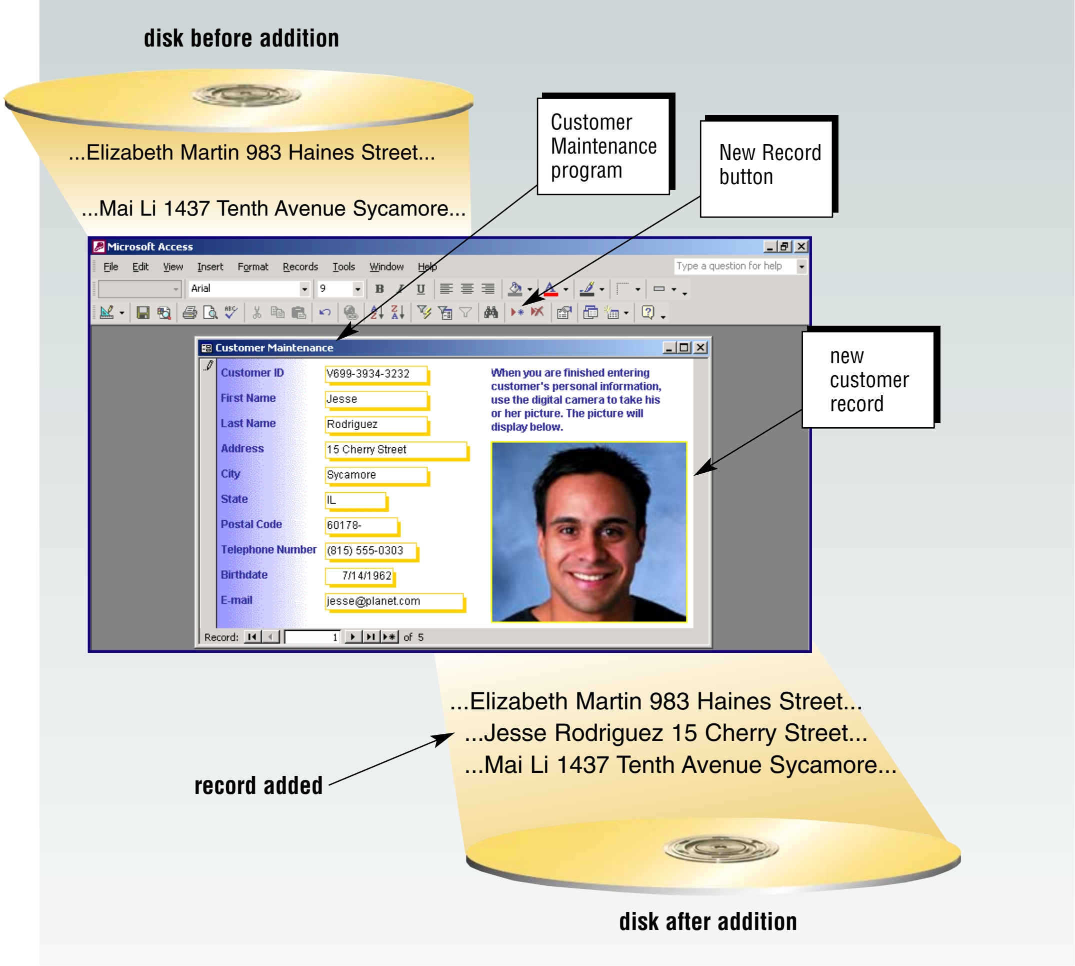
MAINTAINING DATA

File maintenance, also called **data maintenance**, refers to the procedures that keep data current. File maintenance procedures include adding records to, changing records in, and deleting records from a file.

Adding Records

You add new records to a file when you have new data. If a new customer wishes to rent a movie from a video store, the checkout clerk would add a new record to the store's Customer database file. The process required to add this record to the file might include the following steps:

1. A checkout clerk starts a Customer Maintenance program that gives him or her access to the file. The clerk then clicks the New Record button, which begins the process of adding a record to the Customer file.
2. The clerk enters the customer's driver's license number into the Customer ID field. This number serves as the primary key for the new customer record. Every person's driver's license number is unique.
3. The clerk fills in the fields of the customer record with data. In this example, the data entered is kept to a minimum.
4. The clerk takes a picture of the customer using a digital camera. The DBMS stores this picture in the Customer file and prints it on the customer's ID card.


disk before addition
...Elizabeth Martin 983 Haines Street...
...Mai Li 1437 Tenth Avenue Sycamore...
Customer Maintenance program
New Record button
new customer record
Microsoft Access
File Edit View Insert Format Records Tools Window Help
Type a question for help
Arial
9
Customer Maintenance
Record: 1 of 5
...Elizabeth Martin 983 Haines Street...
...Jesse Rodriguez 15 Cherry Street...
...Mai Li 1437 Tenth Avenue Sycamore...
record added
disk after addition

Customer ID V699-3934-3232
First Name Jesse
Last Name Rodriguez
Address 15 Cherry Street
City Sycamore
State IL
Postal Code 60178-
Telephone Number (815) 555-0303
Birthdate 7/14/1962
E-mail jesse@planet.com

When you are finished entering customer's personal information, use the digital camera to take his or her picture. The picture will display below.

Figure 13-4 Using the Customer Maintenance program, a checkout clerk adds a new customer record. After the clerk takes the photograph with the digital camera and confirms the data is correct, he or she adds the record to the database file.

5. The checkout clerk verifies the data on the screen and then presses the TAB key on the keyboard to add the new customer record to the Customer file. The system software that manages the disk determines where to write the record on the disk. In some cases, it writes the new record at the end of the file. In other cases, such as illustrated in Figure 13-4, it writes the new record between existing records in the file.

Changing Records

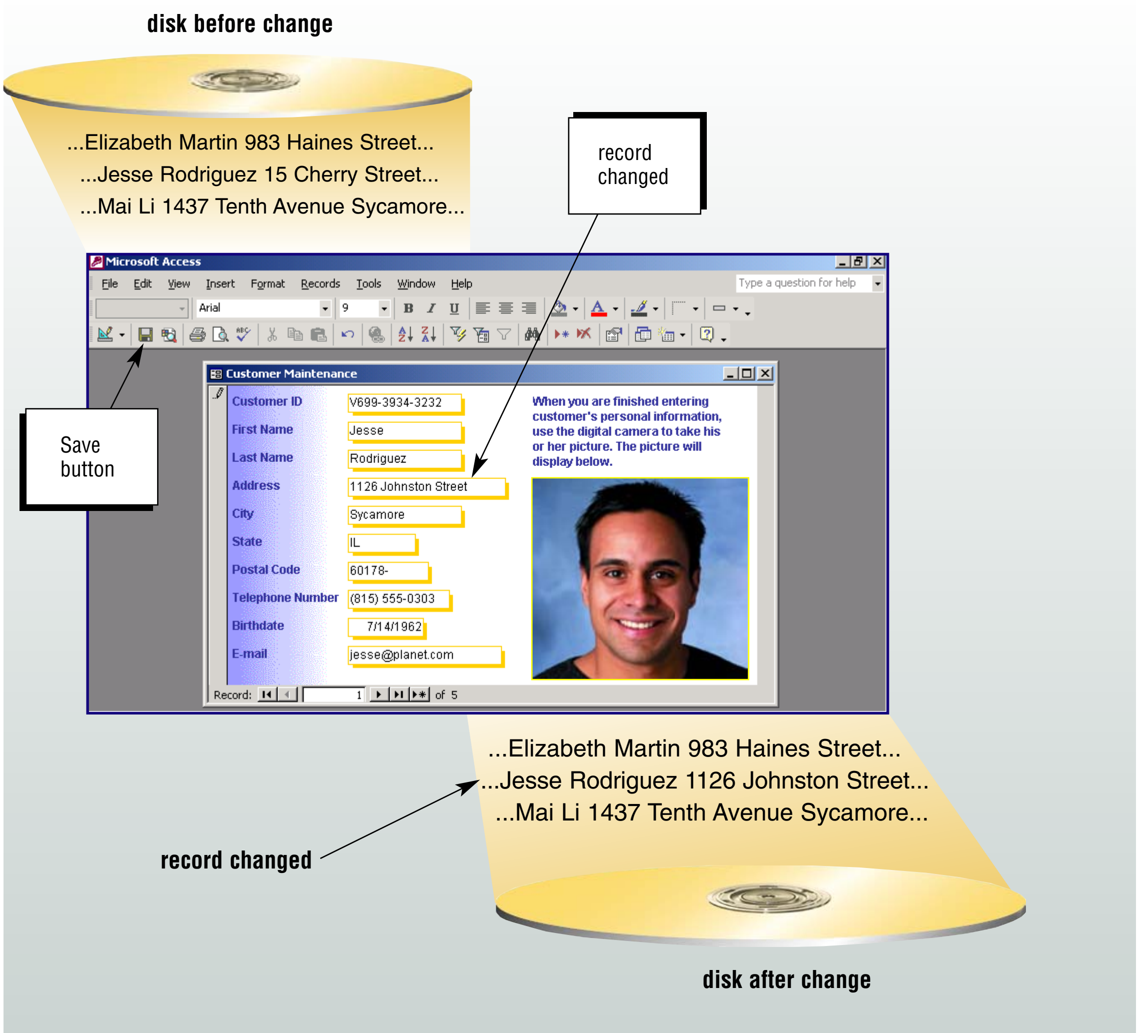
Generally, you change a record in a file for two reasons: (1) to correct inaccurate data or (2) to update old data with new data.

As an example of the first type of change, assume that a checkout clerk enters a customer's home telephone number as (815) 555-0909, instead of (815) 555-0303. The customer notices the error when he reviews his video rental agreement at home. The next time he rents a movie, he requests the clerk correct his telephone number.

To do this, a video store checkout clerk displays the customer's record on the screen by entering the primary key value. Next, the clerk changes this customer's telephone number from (815) 555-0909 to (815) 555-0303. The change corrects the inaccurate data and replaces it with accurate data.

A more common reason to change a record is to update old data with new data. Suppose, for example, that Jesse Rodriguez moves from 15 Cherry Street to 1126 Johnston Street. The process to change the address and update Jesse Rodriguez's record might include the following steps:

1. The checkout clerk starts the Customer Maintenance program.
2. The clerk scans Jesse Rodriguez's customer ID card to display his customer record on the screen. If Jesse did not have his ID card, the clerk could enter Jesse's driver's license number in the Customer ID field. The clerk also could enter Rodriguez in the Last Name field, which would retrieve all customers with that same last name. The clerk then would scroll through all of the retrieved records to determine which one is Jesse's.
3. The program displays data about Jesse Rodriguez. By looking at Jesse's picture on the screen, the clerk can confirm that the correct customer record displays.
4. The clerk enters the new street address of 1126 Johnston Street.
5. The checkout clerk verifies the data on the screen and then clicks the Save button to change the record in the Customer file. The program changes the record on the disk (Figure 13-5).


disk before change
...Elizabeth Martin 983 Haines Street...
...Jesse Rodriguez 15 Cherry Street...
...Mai Li 1437 Tenth Avenue Sycamore...
record changed
Save button
Microsoft Access
File Edit View Insert Format Records Tools Window Help
Type a question for help
Arial
9
Customer Maintenance
Record: 1 of 5
...Elizabeth Martin 983 Haines Street...
...Jesse Rodriguez 1126 Johnston Street...
...Mai Li 1437 Tenth Avenue Sycamore...
record changed
disk after change

Customer ID V699-3934-3232
First Name Jesse
Last Name Rodriguez
Address 1126 Johnston Street
City Sycamore
State IL
Postal Code 60178-
Telephone Number (815) 555-0303
Birthdate 7/14/1962
E-mail jesse@planet.com

When you are finished entering customer's personal information, use the digital camera to take his or her picture. The picture will display below.

Figure 13-5 The checkout clerk scans the customer's ID card to display the customer record. After looking at the photograph on the screen to confirm the correct customer record displays, the clerk changes the customer's address.

Deleting Records

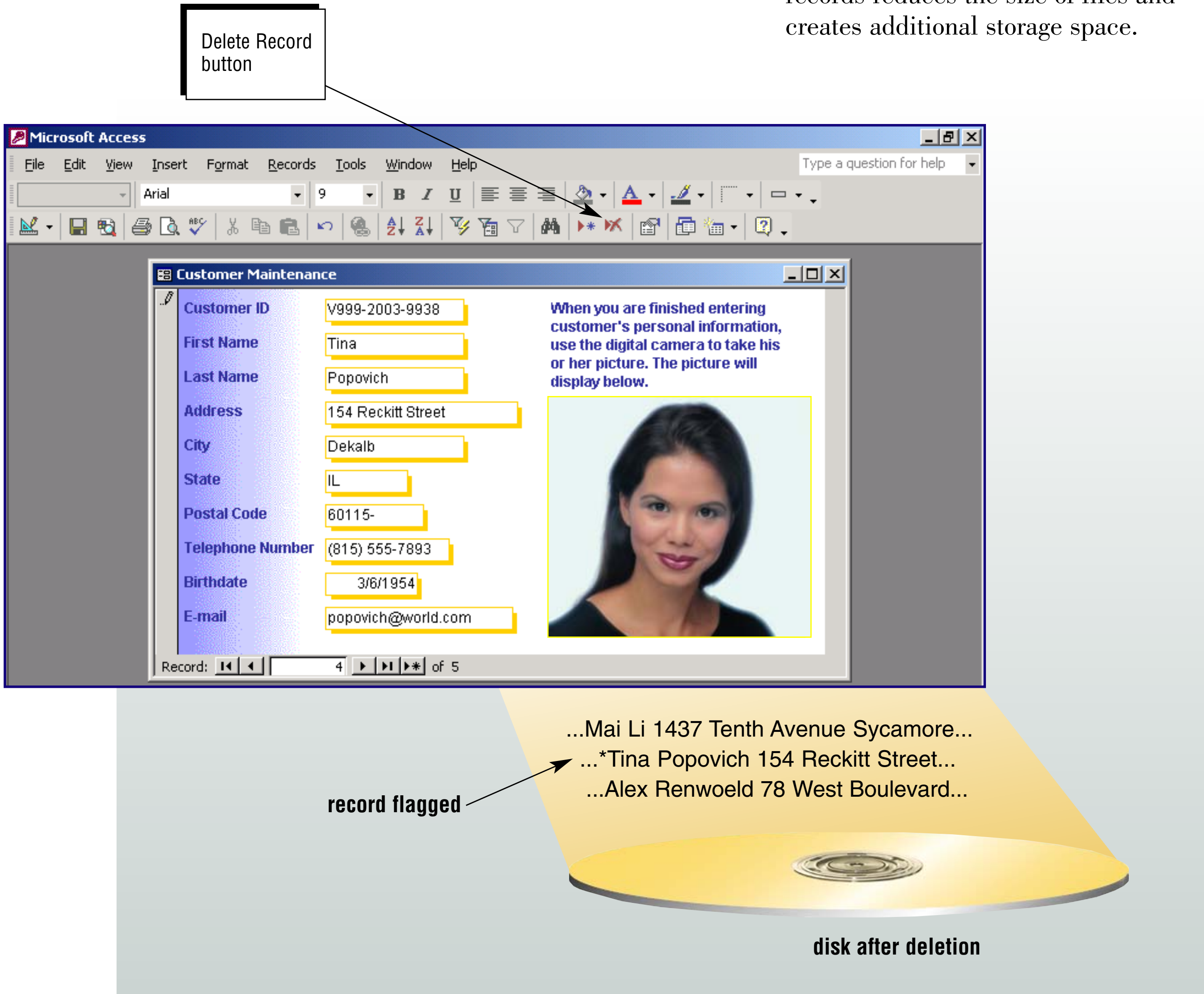
When you no longer need a record, you delete it from a file. Assume a customer named Tina Popovich is moving out of state. The process required to delete a record from a file includes the following steps:

1. The checkout clerk starts the Customer Maintenance program.
2. The clerk scans Tina's customer ID card to display her customer record on the screen.
3. The program displays Tina Popovich's name and other data about Tina on the screen.
4. By looking at Tina's picture on the screen, the clerk can confirm the correct customer record displays. Then, the clerk clicks the Delete Record button to delete the record from the Customer file.

Applications use a variety of techniques to manage deleted records. Sometimes, the program removes the record from the file immediately. Other times, the program does not remove the record from the file. Instead, the record is *flagged* or marked, so the program will not process it again. In this case, the program places an asterisk (*) at the beginning of the record (Figure 13-6).

Applications that maintain inactive data for a period of time commonly flag records. A video rental store might flag closed accounts. When a program flags a deleted record, the record remains physically on the disk. The record, however, is *logically* deleted because the program will not process it. Programs ignore flagged records unless they are instructed to process them.

From time to time, you should run a utility program that removes flagged records and reorganizes current records. For example, the video rental store may remove from disk any accounts that have been closed for more than one year. Deleting unneeded records reduces the size of files and creates additional storage space.



Customer ID: V999-2003-9938
First Name: Tina
Last Name: Popovich
Address: 154 Reckitt Street
City: Dekalb
State: IL
Postal Code: 60115-
Telephone Number: (815) 555-7893
Birthdate: 3/6/1954
E-mail: popovich@world.com

When you are finished entering customer's personal information, use the digital camera to take his or her picture. The picture will display below.

Record: 4 of 5

...Mai Li 1437 Tenth Avenue Sycamore...
...*Tina Popovich 154 Reckitt Street...
...Alex Renwoeld 78 West Boulevard...

Figure 13-6 The checkout clerk displays the customer's record on the screen. After the clerk verifies the correct customer record displays, he or she clicks the Delete Record button to delete the record. The program flags the customer record on disk by placing an asterisk in the first position of the record.

Data Validation

As discussed in Chapter 3, **validation** is the process of comparing data to a set of rules or values to find out if the data is correct. Many programs perform a **validity check** that analyzes entered data to help ensure that it is correct. For instance, when a checkout clerk adds or changes data in a customer record, the DBMS tests the entered data.

With a telephone number, you would expect to see numbers inside the parenthesis and also before and after the hyphen. A valid telephone number is (815) 555-6753. An entry of (SED) ERK-URID clearly is not correct. If the entered data fails a validity check, the computer usually displays an error message and asks you to enter the data again. Validity checks, also called **validation rules**, reduce data entry errors. Validating data enhances its integrity before the program writes the data on disk. Validation reduces the possibility of GIGO (garbage in, garbage out).

Various types of validity checks include alphabetic checks, numeric checks, range checks, consistency checks, completeness checks, and check digits. The table in Figure 13-7 illustrates several validity checks and shows valid data that passes the check and invalid data that fails the check. The following paragraphs describe the purpose of these validity checks.

ALPHABETIC/NUMERIC CHECK An **alphabetic check** ensures that you enter only alphabetic data into a field. A **numeric check** ensures that you enter only numeric data into a field. For example, data in a First Name field should contain only characters from the alphabet. Data in a Telephone Number field should contain numbers (with the exception of the special characters such as the parenthesis and the dash).

RANGE CHECK A **range check** determines whether a number is within a specified range. Assume a video rental store limits a customer to five rentals per day. A range check on the Total Rentals data item ensures it is a value between 1 and 5.

CONSISTENCY CHECK A **consistency check** tests if the data in two or more associated fields is logical. For example, a Due Date cannot occur earlier in time than a Rental Date.

Sample Valid and Invalid Data

Validity Check	Field Being Checked	Valid Data	Invalid Data
Alphabetic Check	First Name	Jesse	Je33e
Numeric Check	Telephone Number	(815) 555-0303	(815) rrr-0303
Range Check	Total Rentals	4	18
Consistency Check	Rental Date Due Date	07-15-2002 07-18-2002	07-18-2002 07-15-2002
Completeness Check	Last Name	Rodriguez	

Figure 13-7 In this table of sample valid and invalid data, the first column lists commonly used validity checks. The second column lists the name of the field that contains data being tested. The third column shows valid data that passes the validity tests. The fourth column shows invalid data that fails the validity tests.

Web Link

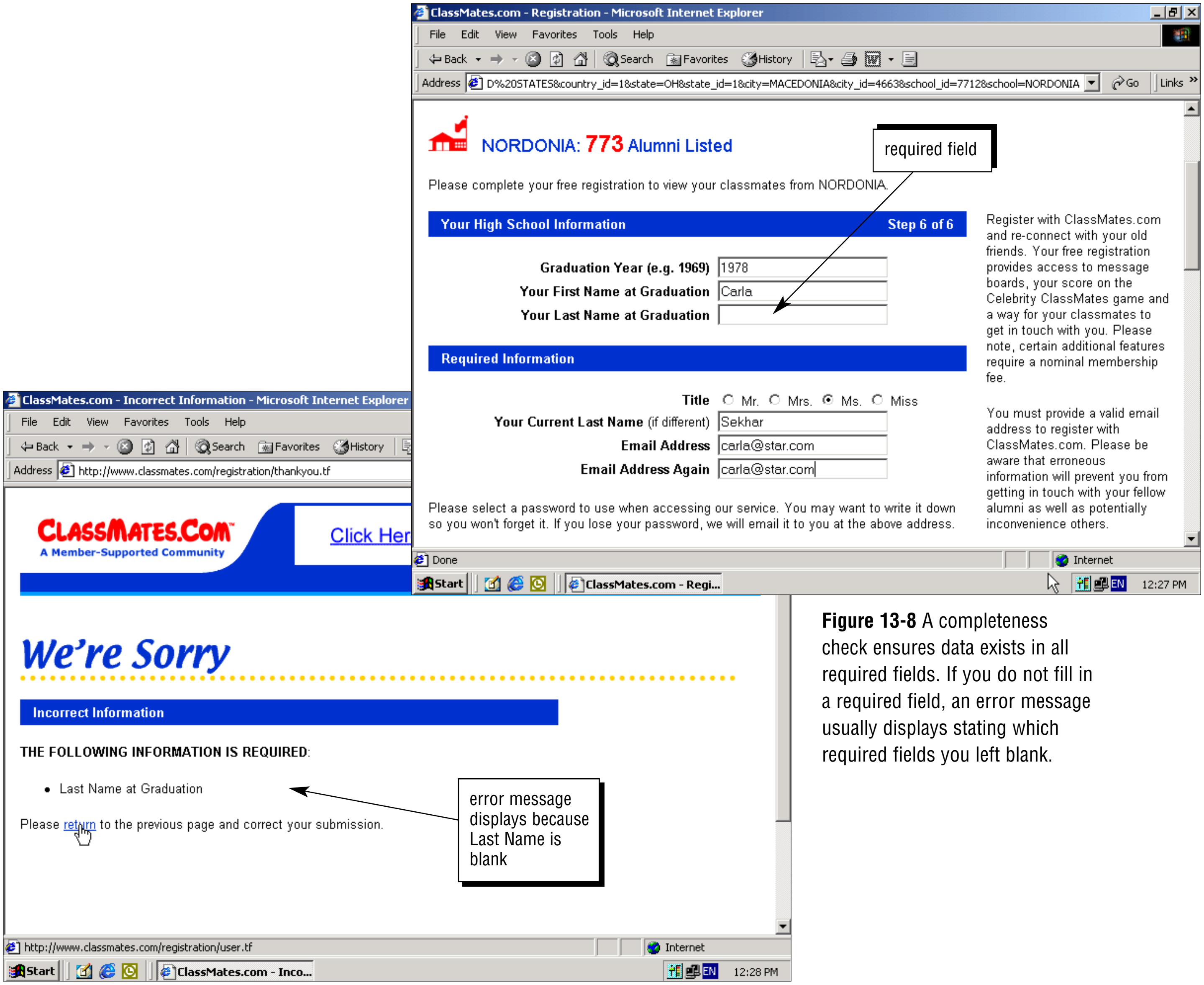
For more information on validity checks, visit the Discovering Computers 2002 Chapter 13 WEB LINK page (**scsite.com/dc2002/ch13/weblink.htm**) and click Validity Checks.

COMPLETENESS CHECK A **completeness check** verifies a required field contains data. In many application programs, you cannot leave the Last Name field blank. The completeness check ensures data exists in the Last Name field (Figure 13-8).

CHECK DIGIT A check digit confirms the accuracy of a primary key value. Bank account, credit card, and other identification numbers often include one or more check digits. A **check digit** is a number(s) or character(s) that is appended to or inserted into a primary key value.

A program determines the check digit by applying a formula to the numbers in the primary key value. An oversimplified illustration of a check digit formula is to add together the numbers in the primary key. For example, if the primary key is 1367, this formula would add together these numbers (1 + 3 + 6 + 7) for a sum of 17. Next, the formula would add together the numbers in the result (1 + 7) to generate a check digit of 8. The primary key then is 13678. This example began with the original primary key value, 1367, then the check digit, 8, was appended.

When a data entry clerk enters the primary key of 13678, the program determines if the check digit is valid. The program applies the check digit formula to the first four digits of the primary key. If the computed check digit matches the entered check digit (8, in this example), the program assumes the entered primary key is valid. If the clerk enters an incorrect primary key, such as 13778, the check digit entered (8) will not match the computed check digit (9). In this case, the program displays an error message and asks the user to enter the primary key value again.


ClassMates.com - Registration - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites History
Address D%20STATES&country_id=1&state=OH&state_id=1&city=MACEDONIA&city_id=4663&school_id=7712&school=NORDONIA
Go Links
Done Internet
Start ClassMates.com - Regi... 12:27 PM

NORDONIA: 773 Alumni Listed

Please complete your free registration to view your classmates from NORDONIA.

Your High School Information Step 6 of 6

Graduation Year (e.g. 1969) 1978
Your First Name at Graduation Carla
Your Last Name at Graduation

Required Information

Title ○ Mr. ○ Mrs. ● Ms. ○ Miss
Your Current Last Name (if different) Sekhar
Email Address carla@star.com
Email Address Again carla@star.com

Please select a password to use when accessing our service. You may want to write it down so you won't forget it. If you lose your password, we will email it to you at the above address.

Register with ClassMates.com and re-connect with your old friends. Your free registration provides access to message boards, your score on the Celebrity ClassMates game and a way for your classmates to get in touch with you. Please note, certain additional features require a nominal membership fee.

You must provide a valid email address to register with ClassMates.com. Please be aware that erroneous information will prevent you from getting in touch with your fellow alumni as well as potentially inconvenience others.

required field

ClassMates.com - Incorrect Information - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites History
Address http://www.classmates.com/registration/thankyou.tf
CLASSMATES.COM
A Member-Supported Community
Click Her
http://www.classmates.com/registration/user.tf Internet
Start ClassMates.com - Inco... 12:28 PM

We're Sorry

Incorrect Information

THE FOLLOWING INFORMATION IS REQUIRED:

- Last Name at Graduation

Please return to the previous page and correct your submission.

error message displays because Last Name is blank

Figure 13-8 A completeness check ensures data exists in all required fields. If you do not fill in a required field, an error message usually displays stating which required fields you left blank.

FILE PROCESSING VERSUS DATABASES

Almost all application programs use either the file processing approach or the database approach to store and manage data. The following sections discuss these two approaches.

File Processing Systems

In the past, many organizations used file processing systems to store and manage data. In a typical **file processing system**, each department or area within an organization has its own set of files. These files often are designed specifically for their own applications. The records in one file often do not relate to the records in any other file.

Figure 13-9 shows how a video rental store might use a file processing system. The computers at the checkout counter might have their own files containing customers' rented movie records. The computer in the store manager's office may have its own set of files for sending promotional mailings to customers.

Companies have used file processing systems for many years. A lot of these systems, however, have two major weaknesses: they have redundant data, and they isolate data.

- **Data Redundancy** – Because each department or area in a company has its own files in a file processing system, the files often store the same fields in multiple files. At the video rental store, for example, the files in the checkout area and the store manager's office store the same customers' names and addresses.

Duplicating data in this manner wastes resources such as storage space and people's time. Storing the same data in more than one file requires a larger storage capacity. When you add or change data, file maintenance takes additional time because people must update more than one file.

Data redundancy also compromises data integrity. If customers change their address, the video rental store must update their address wherever it appears. In this example, the Address field is in the files at the checkout counter and also in the store manager's files. The Address field also may be stored in other areas. If the Address field is not changed in all the files where it is stored, then discrepancies among the files exist.

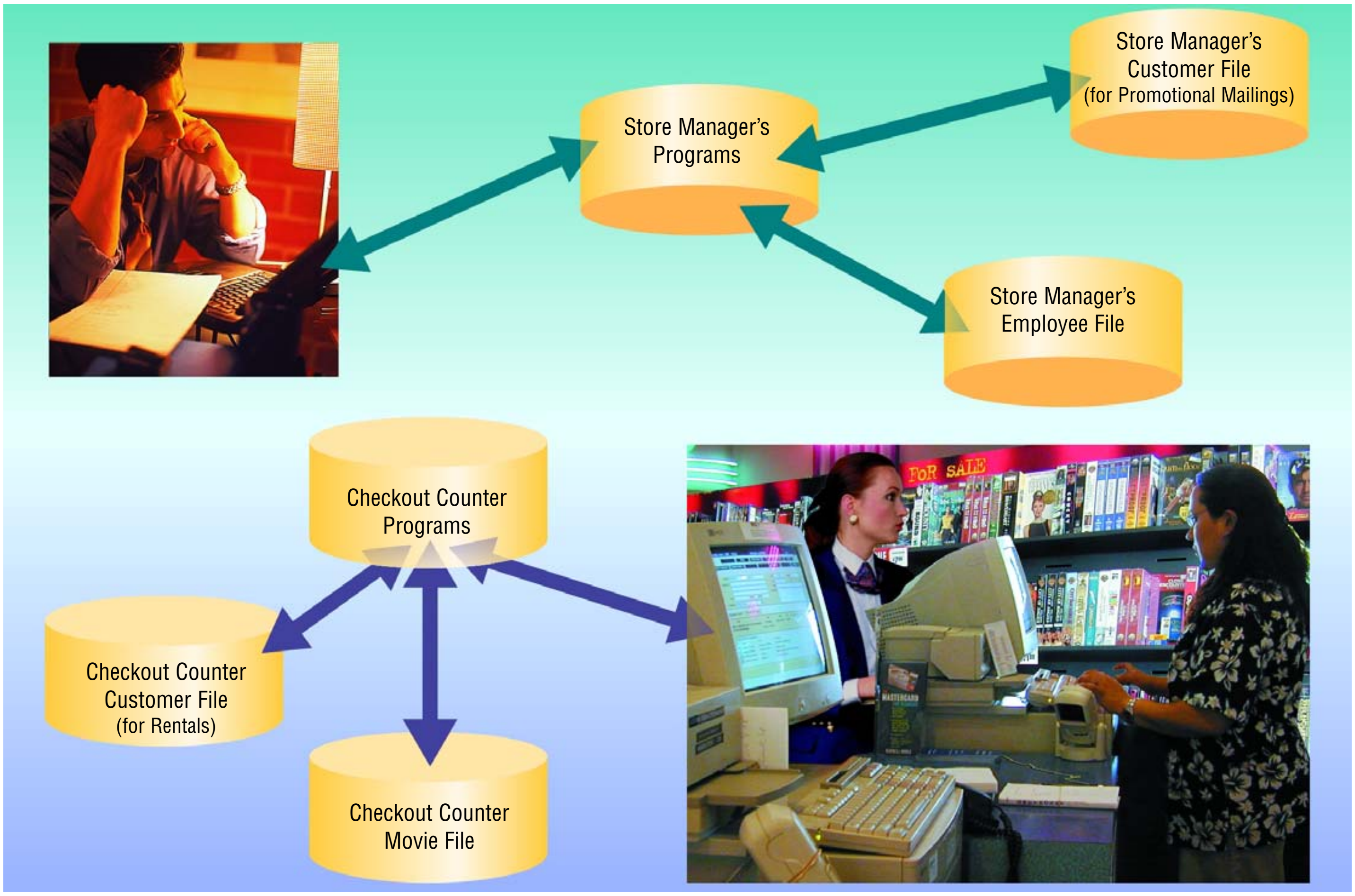

Store Manager's Customer File (for Promotional Mailings)
Store Manager's Programs
Store Manager's Employee File
Checkout Counter Programs
Checkout Counter Customer File (for Rentals)
Checkout Counter Movie File
FoR SALE

Figure 13-9 In a video rental store that uses file processing, the checkout counter area and store manager's computers have their own files that are designed specifically for their applications.

- **Isolated Data** – Often it is difficult to access data stored in many files across several departments. Assume that the customer e-mail addresses are only in the store manager's files, and customer rental information is only in the checkout area files. To send an e-mail message informing a customer that a movie is overdue, you need data from both the checkout area files and the store manager's files. Sharing data from multiple, separate files to generate such a list often is a complicated procedure and typically requires the experience of a computer programmer.

The Database Approach

When a company uses the **database approach**, many programs and users can share the data in the database. A video rental store's database most likely contains data about customers, rentals, movies, and employees. As shown in Figure 13-10, various areas within the store share and interact with the data in this database. The database, however, does secure its data so only authorized users can access certain data items. For example, only the store manager can view an employee's hourly pay rate.

As described in Chapter 3, users can access the data in the database using database software, also called a database management system (DBMS). While a user is working with the database, the DBMS resides in the memory of the computer.

Instead of working with the DBMS, some users interact with a front end. A **front end** is a program that typically has a more user-friendly interface than the DBMS. For example, a checkout clerk interacts with the Movie Rental program. This front-end program interacts with the DBMS, which in turn, interacts with the database. The application that supports the front end sometimes is called the **back end**. In this case, the DBMS is the back-end application.

The database approach addresses many of the weaknesses connected with file processing systems. The following paragraphs present some strengths of the database approach.

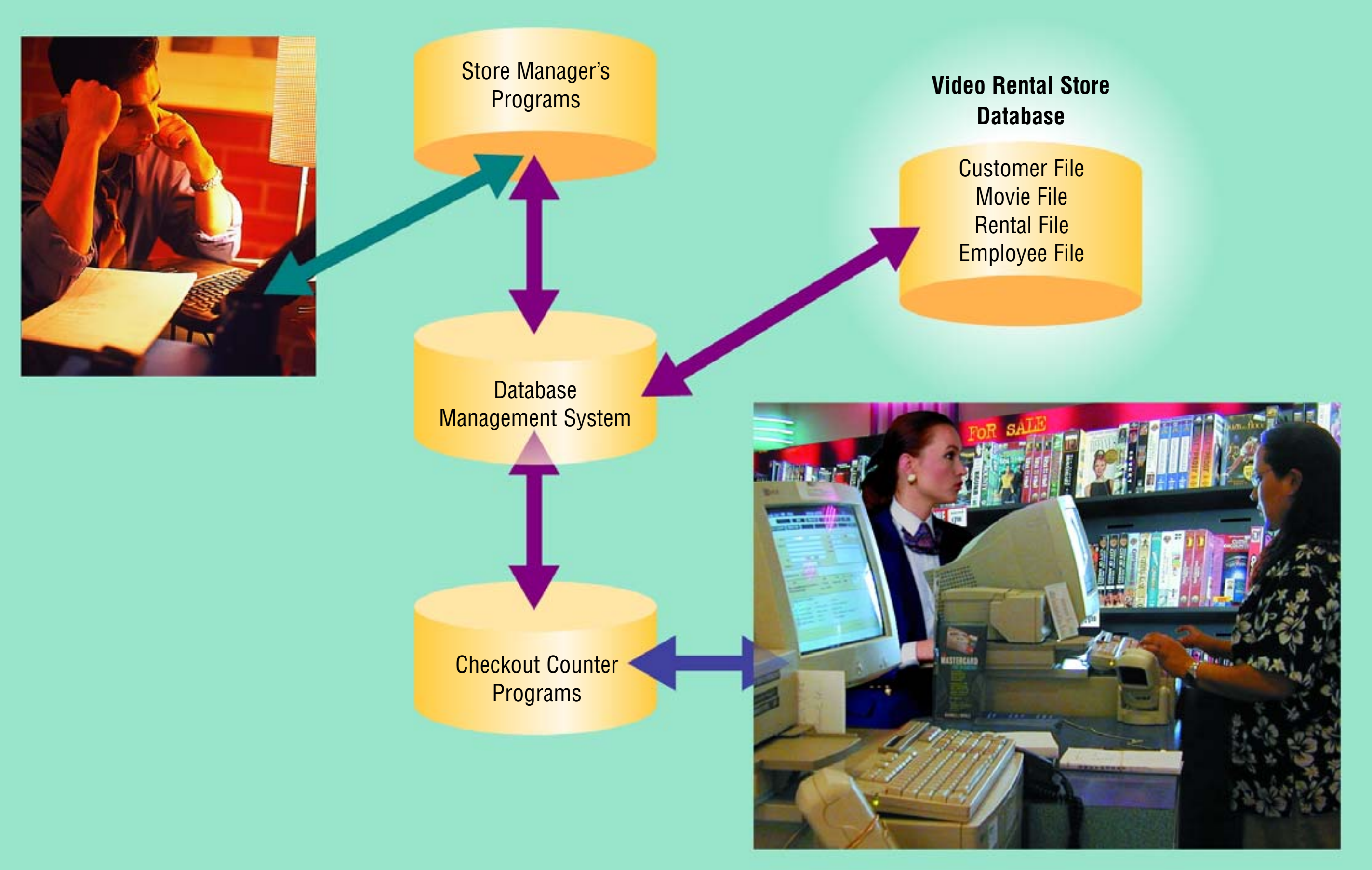


Figure 13-10 In a video rental store that uses a database, the store manager and checkout clerks access data in a single database through the database management system. Employee files, however, are secured, so only authorized users can access them.

- **Reduced Data Redundancy** – A centralized database stores all related data in one location, which greatly reduces duplicate data. A video store database would record a customer's name and address only once. When customer data is entered or changed, one employee makes the change once. Figure 13-11 demonstrates the differences between how a database application and a file processing application might store data.
- **Improved Data Integrity** – When users modify data in the database, they make changes to one file instead of multiple files. Thus, the database approach increases the data's integrity by reducing the chances of introducing inconsistencies.
- **Shared Data** – Each application in a file processing environment often has its own set of files. The data in a database environment, by contrast, belongs to and is shared by the entire organization. This data is independent, or separate from, the programs that access the data. Companies that use databases typically have security settings to define who can access, add, change, and delete the data in a database.
- **Reduced Development Time** – It often is easier and faster to develop programs that use the database approach. Many DBMSs also provide several tools to assist in developing programs, which further reduces the development time. The next section discusses these tools and other DBMS features.
- **Easier Reporting** – The database approach allows nontechnical users to access and maintain data. Many computer users also develop smaller databases themselves, without professional assistance.

Databases have many advantages as well as some disadvantages. A large database can be more complex than a file processing system. People with special training usually develop larger databases and their applications. Larger databases also require more memory, storage, and processing power than file processing systems.

Data in a database is more vulnerable than data in file processing systems. A database stores all data in a single location. Many users and programs share and depend on this data. If the database is not operating properly or is damaged or destroyed, users may not be able to perform their jobs. In some cases, certain application programs may stop working. To protect their valuable database resource, individuals and companies should establish and follow security procedures. Chapter 12 discussed a variety of security methods.

Despite these limitations, many business and home users work with databases because of their tremendous advantages. Although the hardware and software costs to set up a database may seem expensive, long-term benefits exceed the initial costs.

File Processing Example

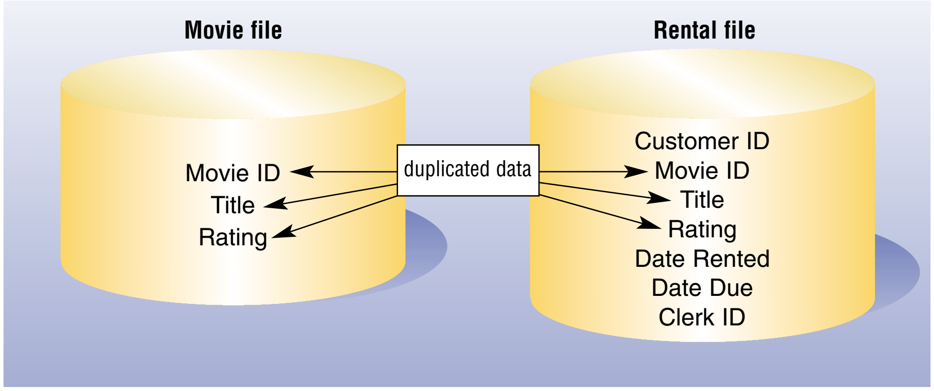
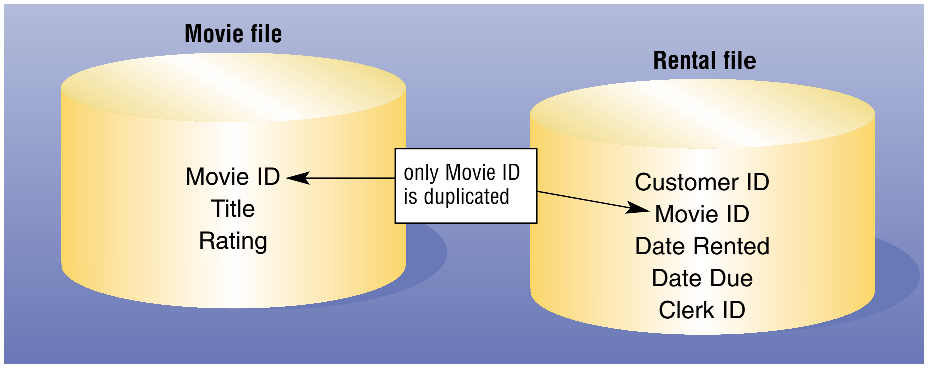


Figure 13-11 In the file processing environment, both files contain the Movie ID, Title, and Rating fields. In a database environment, only the Movie file contains the Title and Rating fields. Other files, such as the Rental file, contain the Movie ID, which is used to retrieve the title and rating data about the movie when it is needed.

Database Example



DATABASE MANAGEMENT SYSTEMS

As previously discussed, a **database management system** (**DBMS**), or database program, is software that allows you to create, access, and manage a database. DBMSs are available for many sizes and types of computers (Figure 13-12). Whether designed for a small or large computer, most DBMSs have common features and functions. The following pages discuss these common elements of a DBMS.

Data Dictionary

A **data dictionary**, sometimes called a **repository**, contains data about each file in the database and each field within those files. For each file, it stores details such as the file name, description, the file's relationship to other files, and the number of records in the file. For each field, it stores details such as the field name, description, field type, field size, default value, validation rules, and the field's relationship to other fields. Figure 13-13 shows how a data dictionary might list data for a Customer file.

Web Link

For more information on database management systems, visit the Discovering Computers 2002 Chapter 13 WEB LINK page (**scsite.com/dc2002/ch13/weblink.htm**) and click Database Management Systems.

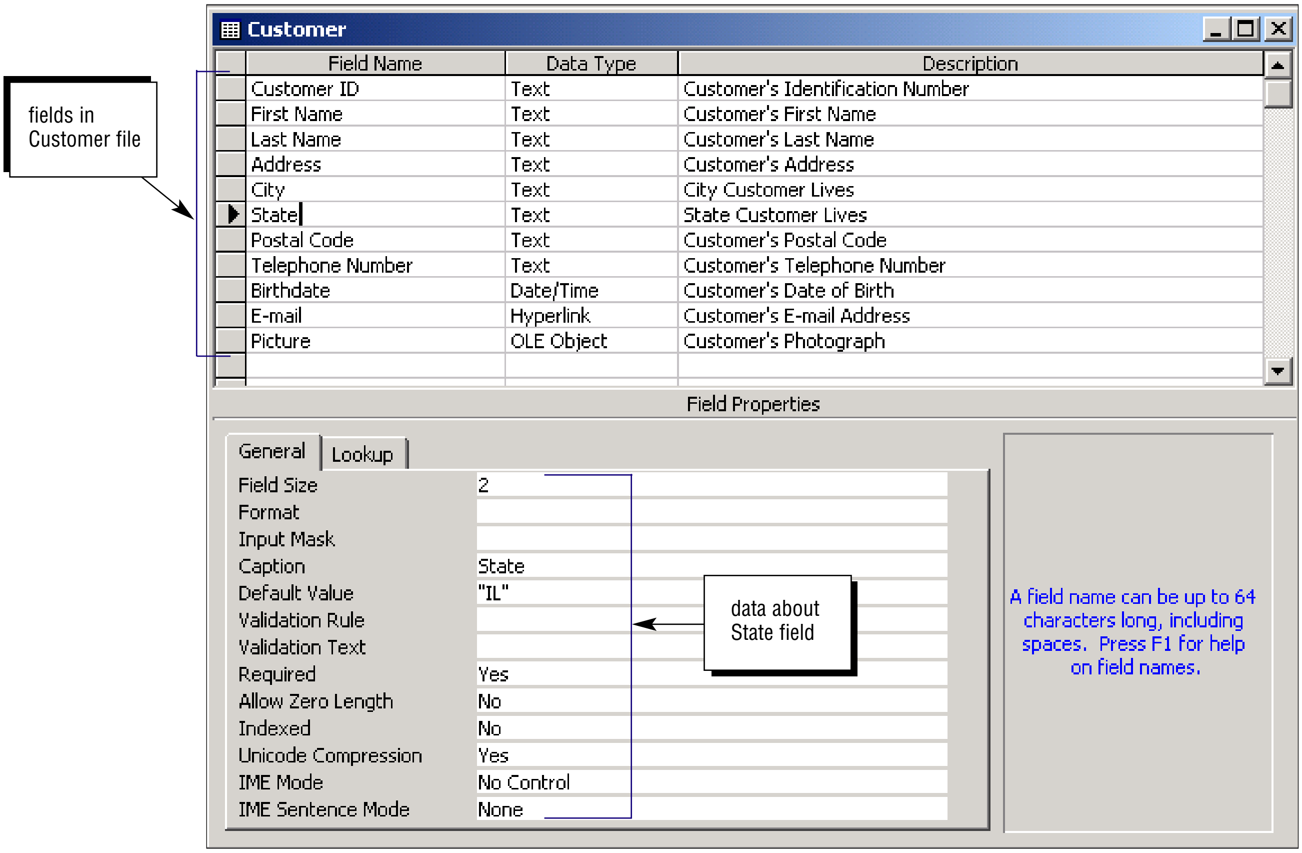
Web Link

For more information on the data dictionary, visit the Discovering Computers 2002 Chapter 13 WEB LINK page (**scsite.com/dc2002/ch13/weblink.htm**) and click Data Dictionary.

Popular Database Management Systems

Database	Manufacturer	Computer Type
Access	Microsoft Corporation	Personal computer, Server
Adabas	Software AG	Server, Minicomputer, Mainframe
Approach	Lotus Development Corporation	Personal computer, Server
D^{3}	Pick Systems	Personal computer, Server, Minicomputer
DB2	IBM Corporation	Personal computer, Server, Minicomputer, Mainframe
Essbase	Hyperion Solutions Corporation	Personal computer, Server
GemStone	GemStone Systems, Inc.	Server, Minicomputer
Informix	Informix Software	Personal computer, Server, Minicomputer, Mainframe
Ingres	Computer Associates International, Inc.	Personal computer, Server, Minicomputer, Mainframe
InterBase	Inprise Corporation	Personal computer, Server
JDataStore	Inprise Corporation	Personal computer, Server
KE Texpress	KE Software, Inc.	Personal computer, Server
Objectivity	Object Design, Inc.	Personal computer, Server, Minicomputer
Oracle	Oracle Corporation	Personal computer, Server, Minicomputer, Mainframe
Paradox	Corel Corporation	Personal computer, Server
POET	POET Software Corporation	Personal computer, Server, Minicomputer
SQL Server	Microsoft Corporation	Server
Sybase	Sybase, Inc.	Handheld and desktop computers, Server, Minicomputer
Versant	Versant Corporation	Personal computer, Server, Minicomputer
Visual FoxPro	Microsoft Corporation	Personal computer, Server

Figure 13-12 Many databases run on multiple types of computers.



fields in Customer file

Field Name	Data Type	Description
Customer ID	Text	Customer's Identification Number
First Name	Text	Customer's First Name
Last Name	Text	Customer's Last Name
Address	Text	Customer's Address
City	Text	City Customer Lives
State	Text	State Customer Lives
Postal Code	Text	Customer's Postal Code
Telephone Number	Text	Customer's Telephone Number
Birthdate	Date/Time	Customer's Date of Birth
E-mail	Hyperlink	Customer's E-mail Address
Picture	OLE Object	Customer's Photograph

Field Properties

Field Size	2
Format	
Input Mask	
Caption	State
Default Value	"IL"
Validation Rule	
Validation Text	
Required	Yes
Allow Zero Length	No
Indexed	No
Unicode Compression	Yes
IME Mode	No Control
IME Sentence Mode	None

data about State field

A field name can be up to 64 characters long, including spaces. Press F1 for help on field names.

Figure 13-13 A sample data dictionary entry showing the fields in the Customer file and the properties of the State field.

Because the data dictionary contains data about data, some call it **metadata**. A data dictionary also sometimes contains data about programs and users. It might keep track of who accessed data and when they accessed it. The data dictionary is a crucial backbone to a DBMS, thus only skilled professionals should update its contents.

A DBMS uses the data dictionary to perform validation checks. When you enter data, the data dictionary verifies that the entered data matches the field's data type. The State field must contain a valid state code such as "IL". By validating data, the data dictionary helps to maintain the integrity of the data.

A data dictionary allows you to specify a default value for a field. A **default value** is a value that the DBMS initially displays in a field. If most customers who rent videos from your store live in Illinois, then the DBMS initially could display IL in the State field. The user does not have to type in a default value. Displaying a default value reduces the possibility of errors. Usually, a user can override a default value if it does not apply for a certain record. For example, you can change the value from IL to WI if the customer lives in Wisconsin.

File Maintenance and Retrieval

A DBMS provides several tools that allow users and programs to maintain and retrieve data in the database. As discussed earlier in this chapter, file maintenance involves adding new records, changing data in existing records, and removing unwanted records from the database.

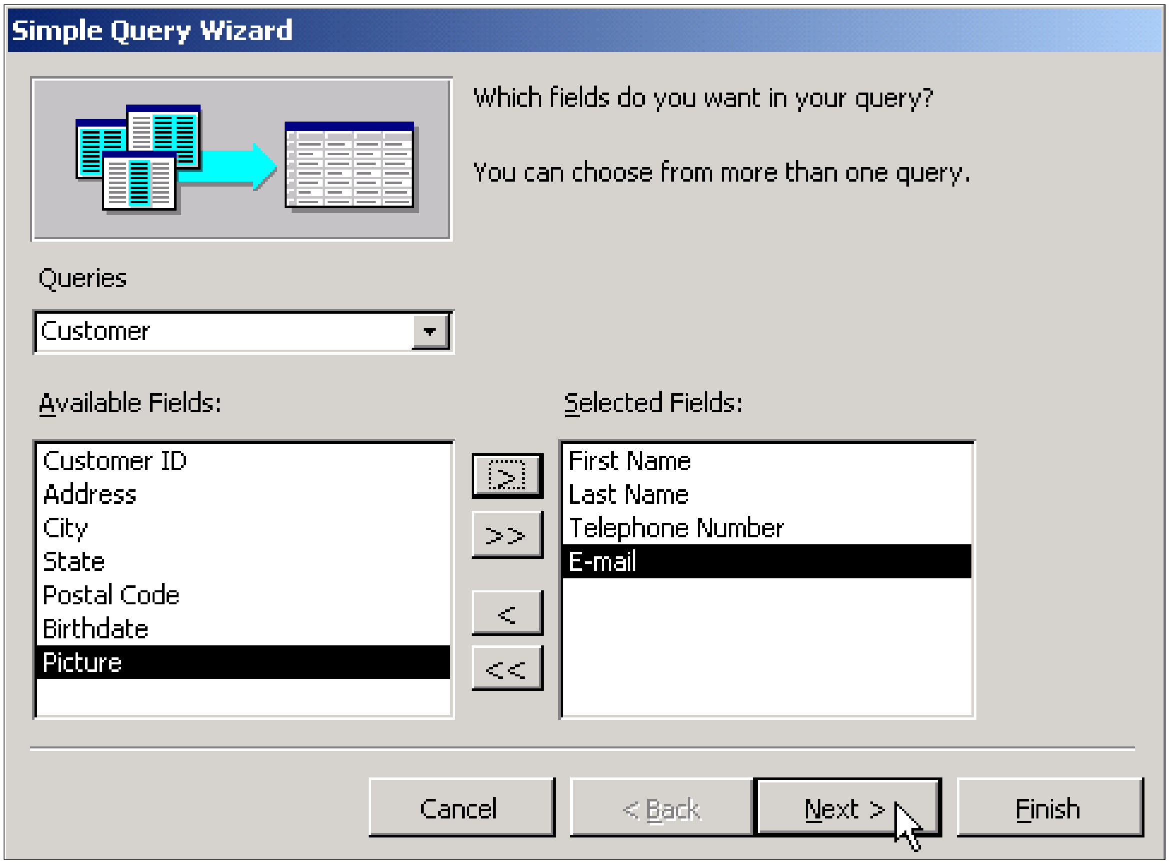
To retrieve or select data in a database, you query it. A **query** is a request for specific data from the database. You can instruct the DBMS to display, print, or store the results of a query. As described in Chapter 3, the capability of querying a database is one of the more powerful database features.

All skill levels of users, from trained experts to nontechnical, maintain and retrieve the data in a database. To deal with this variety of database users, a DBMS offers several methods to access its data. The four most commonly used are query languages, query-by-example, forms, and report generators. The following paragraphs describe each of these methods.

QUERY LANGUAGE A **query language** consists of simple, English-like statements that allow you to specify the data to display, print, or store. Each query language has its own grammar and vocabulary. A person without a programming background usually can learn these languages in a short time.

Although you can use a query language to maintain data, most users only retrieve (query) data with a query language. To simplify the query process, many DBMSs provide wizards to guide you through the steps of creating a query. Figure 13-14 shows a Simple Query Wizard and the query it creates.

Figure 13-14a (wizard for querying the database)



Simple Query Wizard

Which fields do you want in your query?

You can choose from more than one query.

Queries: Customer

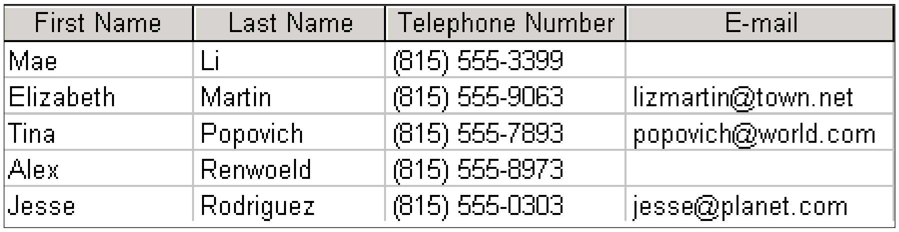
Available Fields:

- Customer ID
- Address
- City
- State
- Postal Code
- Birthdate
- Picture

Selected Fields:

- First Name
- Last Name
- Telephone Number
- E-mail

Figure 13-14b (query results)



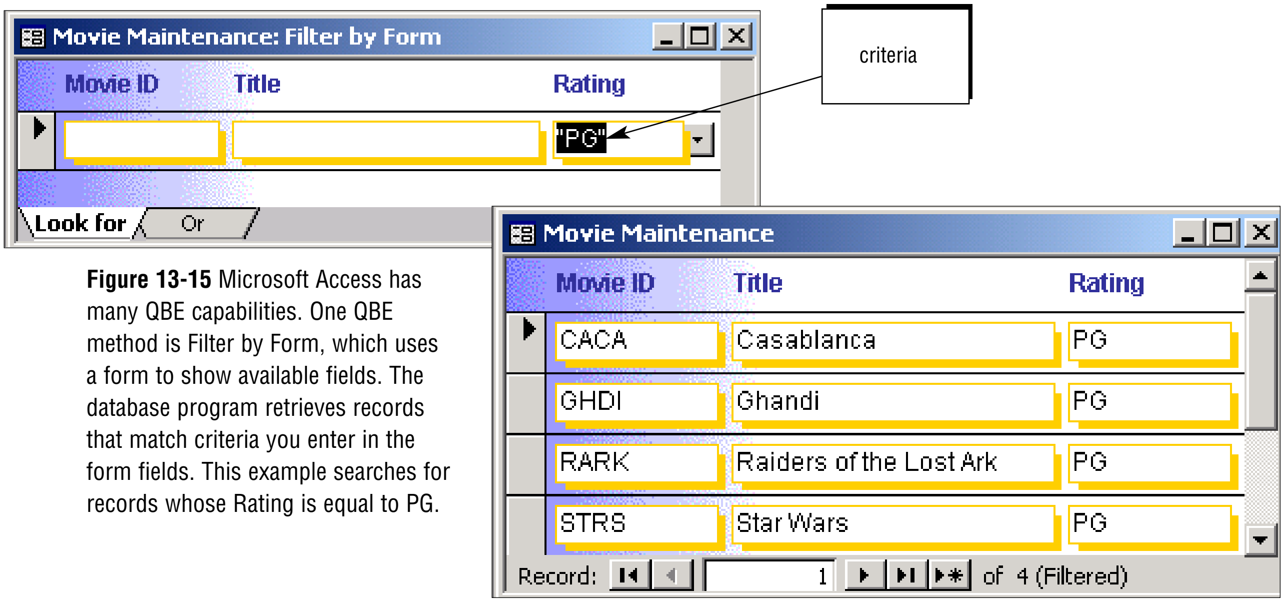
First Name	Last Name	Telephone Number	E-mail
Mae	Li	(815) 555-3399	
Elizabeth	Martin	(815) 555-9063	lizmartin@town.net
Tina	Popovich	(815) 555-7893	popovich@world.com
Alex	Renwoeld	(815) 555-8973	
Jesse	Rodriguez	(815) 555-0303	jesse@planet.com

Figure 13-14 In the Simple Query Wizard, you indicate which fields to display in the query results. The query shown displays the First Name, Last Name, Telephone Number, and E-mail fields for customers in the Customer file. The list is sorted alphabetically by Last Name. For a list of all fields in the Customer file, see Figure 13-3 on page 13.5.

QUERY BY EXAMPLE Instead of learning the grammar and vocabulary associated with a query language, you can use a **query by example** (**QBE**) to request data from the database. Most DBMSs include a QBE feature. QBEs have a graphical user interface that assists you with retrieving data. Figure 13-15 shows a sample QBE screen for a query that searches for and lists movies with a "PG" rating. Later in the chapter, specific query languages are presented in more depth.

FORM A **form**, sometimes called a **data entry form**, is a window on the screen that provides areas for entering or changing data in a database. You use forms to retrieve (see Figure 13-15) and maintain (Figure 13-16) the data in a database.

Figure 13-15a (query by example screen)



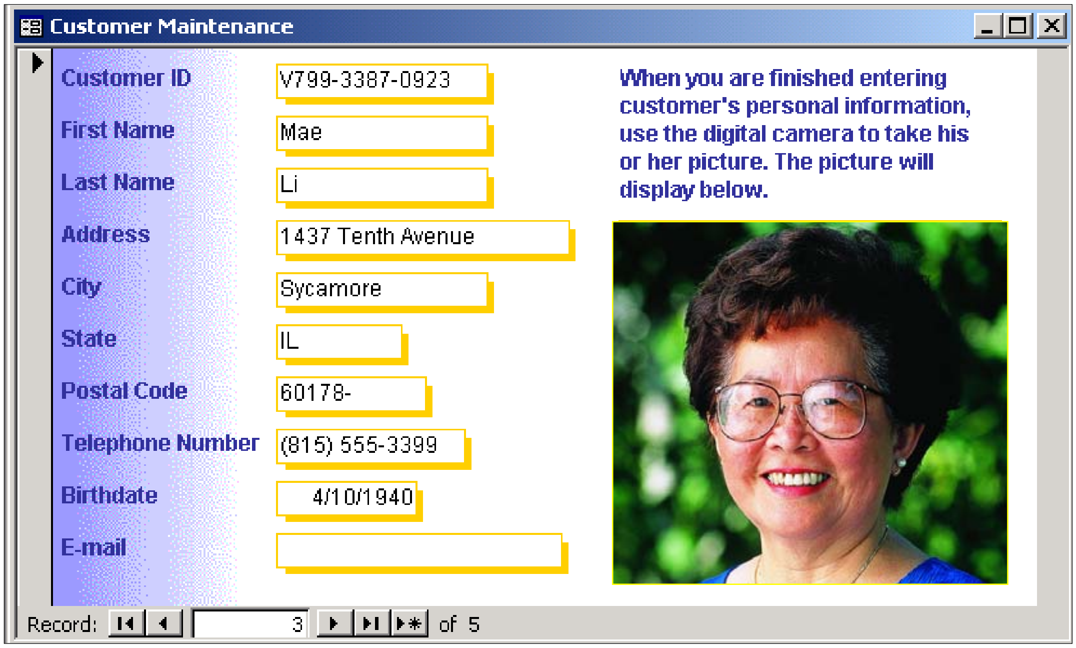
Movie ID	Title	Rating
		"PG"

Movie ID	Title	Rating
CACA	Casablanca	PG
GHDI	Ghandi	PG
RARK	Raiders of the Lost Ark	PG
STRS	Star Wars	PG

Record: 1 of 4 (Filtered)

Figure 13-15b (query results)

Figure 13-15 Microsoft Access has many QBE capabilities. One QBE method is Filter by Form, which uses a form to show available fields. The database program retrieves records that match criteria you enter in the form fields. This example searches for records whose Rating is equal to PG.



Customer ID	V799-3387-0923
First Name	Mae
Last Name	Li
Address	1437 Tenth Avenue
City	Sycamore
State	IL
Postal Code	60178-
Telephone Number	(815) 555-3399
Birthdate	4/10/1940
E-mail	

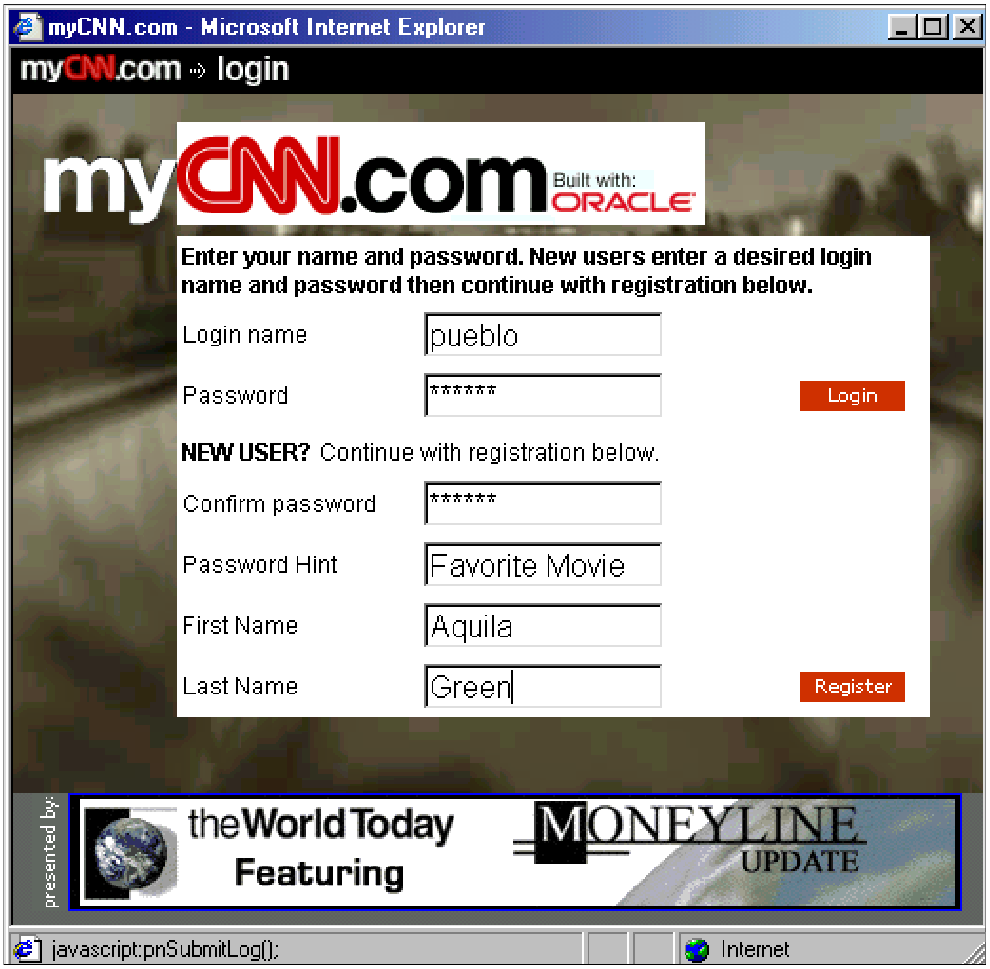
When you are finished entering customer's personal information, use the digital camera to take his or her picture. The picture will display below.

Record: 3 of 5

Figure 13-16 This form, created in Microsoft Access, is used to add customers to the Customer file.

To reduce data entry errors, well-designed forms validate data as it is input. When designing a form using a DBMS, you can make the form attractive and easy to use by incorporating color, shading, lines, boxes, and graphics; varying the fonts and font styles; and using other formatting features.

A form that sends entered data across a network or the Internet is called an **electronic form**, or **e-form** (Figure 13-17). E-forms typically use a means to secure the data while it is transported across the network. Often, the data in the e-form automatically updates data in a database on the network or the Internet. Thus, many DBMSs include the capability to create e-forms.


myCNN.com - Microsoft Internet Explorer
myCNN.com ⇨ login
myCNN.com Built with: ORACLE
Login
Register
presented by:
the World Today
Featuring
MONEYLINE UPDATE
javascript:pnSubmitLog();
Internet

Enter your name and password. New users enter a desired login name and password then continue with registration below.

Login name	pueblo
Password	******

NEW USER? Continue with registration below.

Confirm password	******
Password Hint	Favorite Movie
First Name	Aquila
Last Name	Green

Figure 13-17 This e-form, created with Oracle, sends your registration information to a database at CNN.

ISSUE

Who Can You Trust?

E-Forms and Your Personal Information

Who can you trust? While surfing the Internet you come across an interesting site. The headline invites you to take a minute to enroll. In return for your time, the Web site states you will receive a lifetime of savings. The offer seems too good to pass up, so you type in your name, e-mail, home address, and telephone number. As soon as you click the Submit button, the information is whisked away, where it is added to a huge database. Within seconds, the information you entered is most likely traveling via high-speed networks halfway around the world. The company now has your personal information and can sell your name, address, and telephone number to dozens of marketing firms, without your knowledge or consent. How do you feel about this? Do you think a company should have the option to sell your personal information? Some sites post privacy statements and a TRUSTe seal. Would you feel confident leaving your information at one of these sites? How do you know that you can trust this company and that the seal is legitimate?

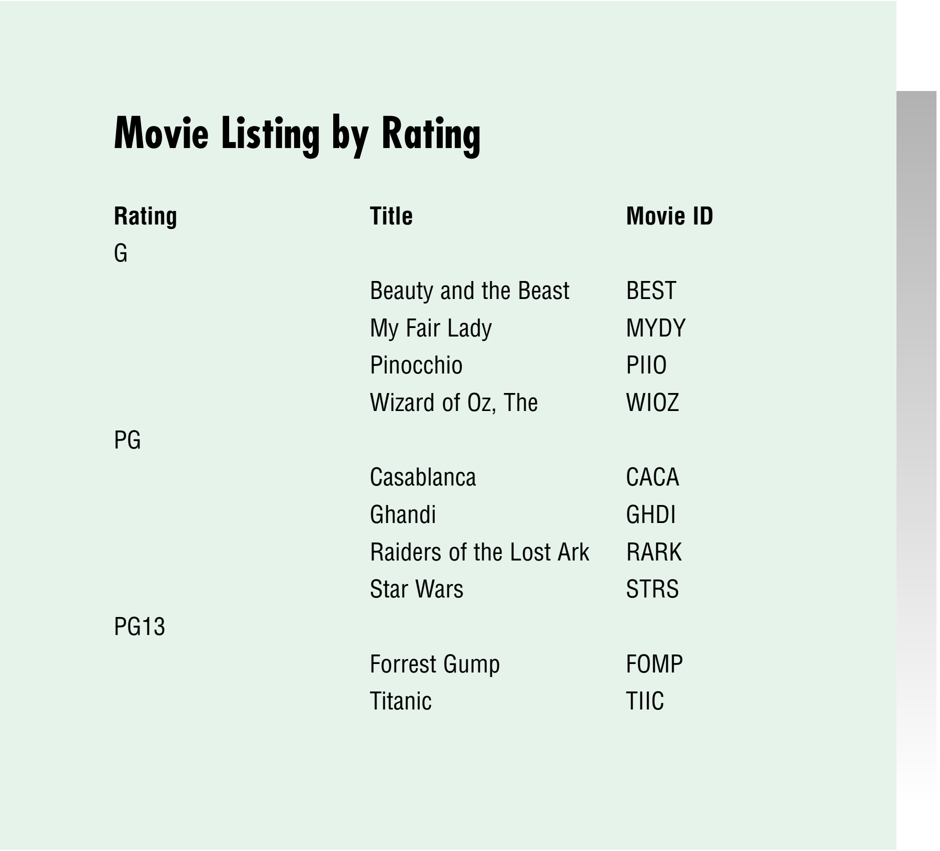
For more information on privacy, visit the Discovering Computers 2002 Issues Web page (**scsite.com/dc2002/issues.htm**) and click Chapter 13 Issue #1.

REPORT GENERATOR A **report generator**, also called a **report writer**, allows you to design a report on the screen, retrieve data into the report design, and then display or print the report (Figure 13-18). Unlike a form, you use a report generator only to retrieve data. Report generators usually allow you to format page numbers and dates; titles and column headings; subtotals and totals; and fonts, font sizes, color, and shading.

Data Security

Sometimes, users accidentally delete the data from a database; others misuse the data intentionally. Thus, a DBMS provides means to make certain only authorized users can access data at permitted times. In addition, most DBMSs allow you to identify different levels of access privileges for each field in the database. These **access privileges** define the activities that a specific user or group of users can perform.

Access privileges for data involve establishing who can enter new data, change existing data, delete unwanted data, and retrieve data. In the movie database, a checkout clerk might have **read-only privileges** for movie ratings. The clerk could retrieve the movie rating data, but cannot change it. The store manager, by contrast, would have **full-update privileges** to movie data, meaning they can retrieve and change the data. Finally, a customer would have no access privileges to the movie data. Customers can neither retrieve nor change the data. Chapter 12 discussed access privileges and other security techniques in more depth.



Movie Listing by Rating

Rating	Title	Movie ID
G		
	Beauty and the Beast	BEST
	My Fair Lady	MYDY
	Pinocchio	PIIO
	Wizard of Oz, The	WIOZ
PG		
	Casablanca	CACA
	Ghandi	GHDI
	Raiders of the Lost Ark	RARK
	Star Wars	STRS
PG13		
	Forrest Gump	FOMP
	Titanic	TIIC

Figure 13-18 This report, created in Microsoft Access, displays movie titles by movie ratings.

ISSUE

Background Checks

Retrieving Personal Information from the Internet

If you are concerned about your privacy on the Internet, you should be. In fact, you may be shocked to learn what type of personal information is available about anyone and how easy it is to purchase. Much of this information is available through public records and has been freely available for years. Before the Internet, however, it was difficult to locate and search the databases. Now much of it is there — most of it is free for the asking, and some for a small price. Are you curious about your new neighbors and how much they paid for the house next door? What about the misfit on the next block? Does he have a tainted background? The company where you work just hired a new manager, who claims to have a degree in MIS. You have your doubts, based on your observations. Does she really have that degree? You can find the answers to these questions and many more by searching public records or using an online search company. What privacy issues do you see here? Is this a good or bad practice? How could this affect you personally? Would you use one of these online search services?

For more information on public records, visit the Discovering Computers 2002 Issues Web page (**scsite.com/dc 2002/issues.htm**) and click Chapter 13 Issue #2.

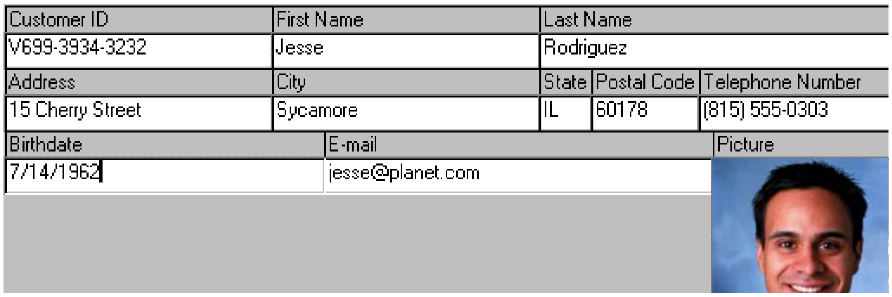
Backup and Recovery

Occasionally a database is damaged or destroyed because of hardware failure, a problem with the software, human error, or a catastrophe such as fire or flood. A DBMS provides a variety of techniques to restore the database to a usable form in case it is damaged or destroyed.

- On a regular basis, you should make a **backup**, or copy, of the entire database. Some DBMSs have their own backup utilities. Others require you to purchase a separate backup utility, or use one included with your operating system.
- More complex DBMSs maintain a **log**, which is a listing of activities that change the contents of the database. If you modify a customer address, for example, the change appears in the log. The DBMS places the following in the log: (1) a copy of the customer record prior to the change, called the **before image**; (2) the actual change of address data; and (3) a copy of the customer record after the change, called the **after image** (Figure 13-19).
- A DBMS that creates a log usually provides a recovery utility. A **recovery utility** uses the logs and/or backups to restore a database when it is damaged or destroyed. The recovery utility restores the database using rollback and rollforward techniques. In a **rollforward**, also called **forward recovery**, the DBMS uses the log to re-enter changes made to the database since the last save or backup. In a **rollback**, also called **backward recovery**, the DBMS uses the log to undo any changes made to the database during a certain period of time, such as an hour. The rollback restores the database to its condition prior to the failure. Then, you must re-enter any transactions entered after the failure.

Depending on the type of failure, the DBMS determines which type of recovery technique to use. For example, if the database is destroyed by a lightning strike, the DBMS would rollforward from the last backup. Assume, however, that a power failure happens at 3:15 p.m. and shuts down all computers, but does not destroy any data. Because some users may have been in the middle of entering transactions, the DBMS needs to undo any partial transactions. Thus, it would rollback to 3:00 p.m. and send a message to all users that they need to re-enter any transactions made after that time.

Figure 13-19a (before image)

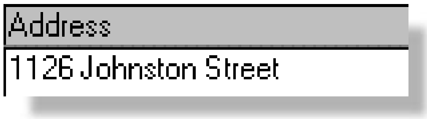


Customer ID	First Name	Last Name
V699-3934-3232	Jesse	Rodriguez

Address	City	State	Postal Code	Telephone Number
15 Cherry Street	Sycamore	IL	60178	(815) 555-0303

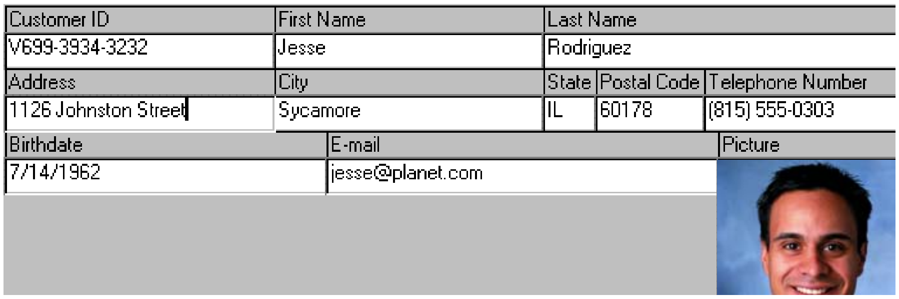
Birthdate	E-mail	Picture
7/14/1962	jesse@planet.com	

Figure 13-19b (change)



Address
1126 Johnston Street

Figure 13-19c (after image)



Customer ID	First Name	Last Name
V699-3934-3232	Jesse	Rodriguez

Address	City	State	Postal Code	Telephone Number
1126 Johnston Street	Sycamore	IL	60178	(815) 555-0303

Birthdate	E-mail	Picture
7/14/1962	jesse@planet.com	

Figure 13-19 If you change the contents of a record, the DBMS places three items in the log: before image of the record; the actual change; and the after image of the record.

RELATIONAL, OBJECT-ORIENTED, AND MULTIDIMENSIONAL DATABASES

Every database and DBMS is based on a specific data model. A **data model** consists of rules and standards that define how the database organizes data. A data model defines how users view the organization of the data. It does not define how the operating system actually arranges the data on the disk.

Three popular data models in use today are relational, object-oriented, and multidimensional. A database typically is based on one data model. For example, when using a relational database, you work with the relational data model. Some databases are **object-relational databases** and combine features of the relational and object-oriented data models.

The table in Figure 13-20 lists some popular DBMSs and the data model on which they are based. The following sections discuss the features of relational, object-oriented, and multidimensional databases.

Data Models and Associated DBMSs

Data Model	Popular DBMSs
Relational Databases	Access
	Adabas
	Approach
	Informix
	Ingres
	InterBase
	Paradox
	SQL Server
	Sybase
	Visual FoxPro
Object-oriented Databases	GemStone
	KE Texpress
	Objectivity
	Objectstore
	POET
	Versant
Object-relational Databases	DB2
	JDataStore
	Oracle
	Polyhedra
	PostgreSQL
Multidimensional Databases	D^3
	Essbase
	Oracle Express

Figure 13-20 Four popular data models are relational, object-oriented, object-relational, and multidimensional. Most DBMSs are based on one of these models.

COMPANY ON THE CUTTING EDGE

ORACLE

Supplying the World with E-Business Solutions

When 96 percent of the Fortune 500 companies use software produced by one company, that company must be flexible, accountable, and effective. Indeed, Oracle Corporation fits those requirements, for its products are available in nearly 30 languages and used by customers in more than 145 countries.

These corporations range from Xerox, which uses Oracle products to purchase and manage goods and services, to UPS, which uses the software to coordinate shipping activities to ensure that packages arrive at the customers' locations on time.

In 1977, Larry Ellison co-founded Oracle. Today, the company, based in Redwood Shores, CA, is the world's leading supplier of software for e-business. The software runs on computers as large as parallel systems to as small as PDAs. Its database product, aptly named Oracle, is the world's leading database software.

For more information on Oracle Corporation, visit the Discovering Computers 2002 Companies Web page (**scsite.com/dc2002/companies.htm**) and click Oracle Corporation.

Relational Databases

Today, a relational database is a widely used type of database. A **relational database** stores data in tables that consist of rows and columns. Each row has a primary key and each column has a unique name.

As discussed earlier in this chapter, a file processing environment uses the terms file, record, and field to represent data. A relational database uses terms different from a file processing environment. A developer of a relational database refers to a file as a **relation**, a record as a **tuple**, and a field as an **attribute**. A user of a relational database, by contrast, refers to a file as a **table**, a record as a **row**, and a field as a **column**. Figure 13-21 shows this varied terminology.

In addition to storing data, a relational database also stores data relationships. A **relationship** is a connection within the data. In a relational database, you can set up a relationship between tables at any time. The tables must have a common column (field). For example, you would relate the Movie table and the Rental table using the Movie ID column. Figure 13-22 illustrates these relational database concepts. In a relational database, the only data redundancy (duplication) exists in the common columns (fields). The database uses these common columns for relationships.

A developer of relational databases uses normalization to organize the data. **Normalization** is a process designed to make sure the data within the relations (tables) contains the least amount of duplication.

Web Link

For more information on relational databases, visit the Discovering Computers 2002 Chapter 13 WEB LINK page (**scsite.com/dc2002/ch13/weblink.htm**) and click Relational Databases.

TECHNOLOGY TRAILBLAZER

E.F. CODD

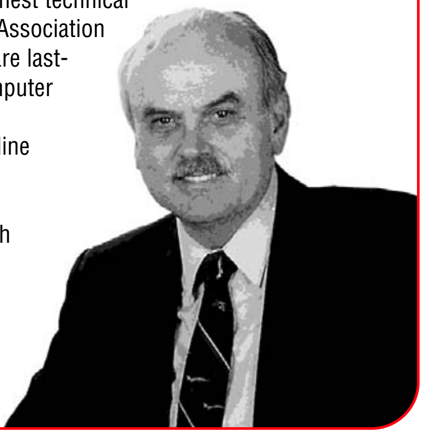
Known as the liberator of information from the computer, Dr. Edgar F. Codd has had a profound effect on data access. In 1970, he created the relational approach to database management in a series of research papers that quickly became the standard for database development.

Codd's model continues to serve as the de facto standard on which large and small databases are structured. In the 1950s, Codd participated in the development of several important IBM products. He then turned his focus to large commercial databases and developed his relational model as a foundation. Codd's widely published 12 rules are based on a single foundation principle, called Rule Zero, mandating that any system identified as a relational database management system must be able to manage databases entirely through its relational capabilities. In essence, Codd followed Einstein's advice; "Make it as simple as possible, but no simpler."

In 1981, Dr. Codd received the prestigious ACM A.M. Turing Award for Relational Database Management Theory, the highest technical achievement honor given to an individual by the Association for Computing Machinery for contributions that are lasting and of major technical importance to the computer community.

In 1993, Codd published a paper defining online analytical processing (OLAP) which has resulted in significant growth in the OLAP market. Data warehouses and multidimensional databases such as Oracle Express use the OLAP concept.

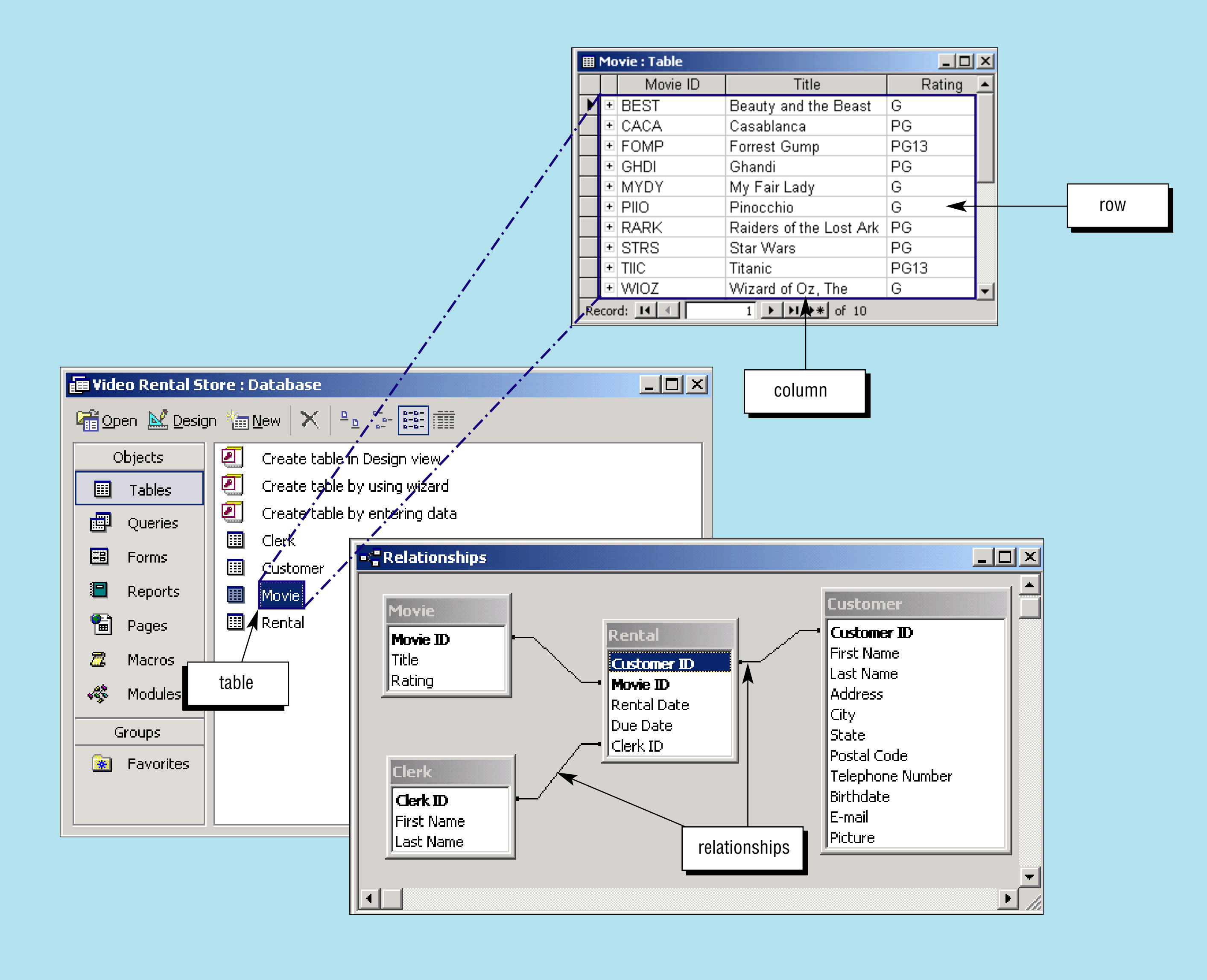
For more information on E. F. Codd, visit the Discovering Computers 2002 People Web page (**scsite.com/dc2002/people.htm**) and click E. F. Codd.



Data Terminology

File Processing Developer	Relational Database Developer	Relational Database User
File	Relation	Table
Record	Tuple	Row
Field	Attribute	Column

Figure 13-21 In this data terminology table, the first column identifies the terms used in a file processing environment. The second column presents the terms used by developers of a relational database. The third column indicates terms to which the users of a relational database refer.



Movie : Table

Movie ID	Title	Rating
BEST	Beauty and the Beast	G
CACA	Casablanca	PG
FOMP	Forrest Gump	PG13
GHDI	Ghandi	PG
MYDY	My Fair Lady	G
PIIO	Pinocchio	G
RARK	Raiders of the Lost Ark	PG
STRS	Star Wars	PG
TIIC	Titanic	PG13
WIOZ	Wizard of Oz, The	G

Record: 1 of 10

Figure 13-22 The Movie table is linked to the Rental table through the Movie ID column. The Rental table is linked to the Customer table through the Customer ID column. The Clerk table is linked to the Rental table through the Clerk ID column.

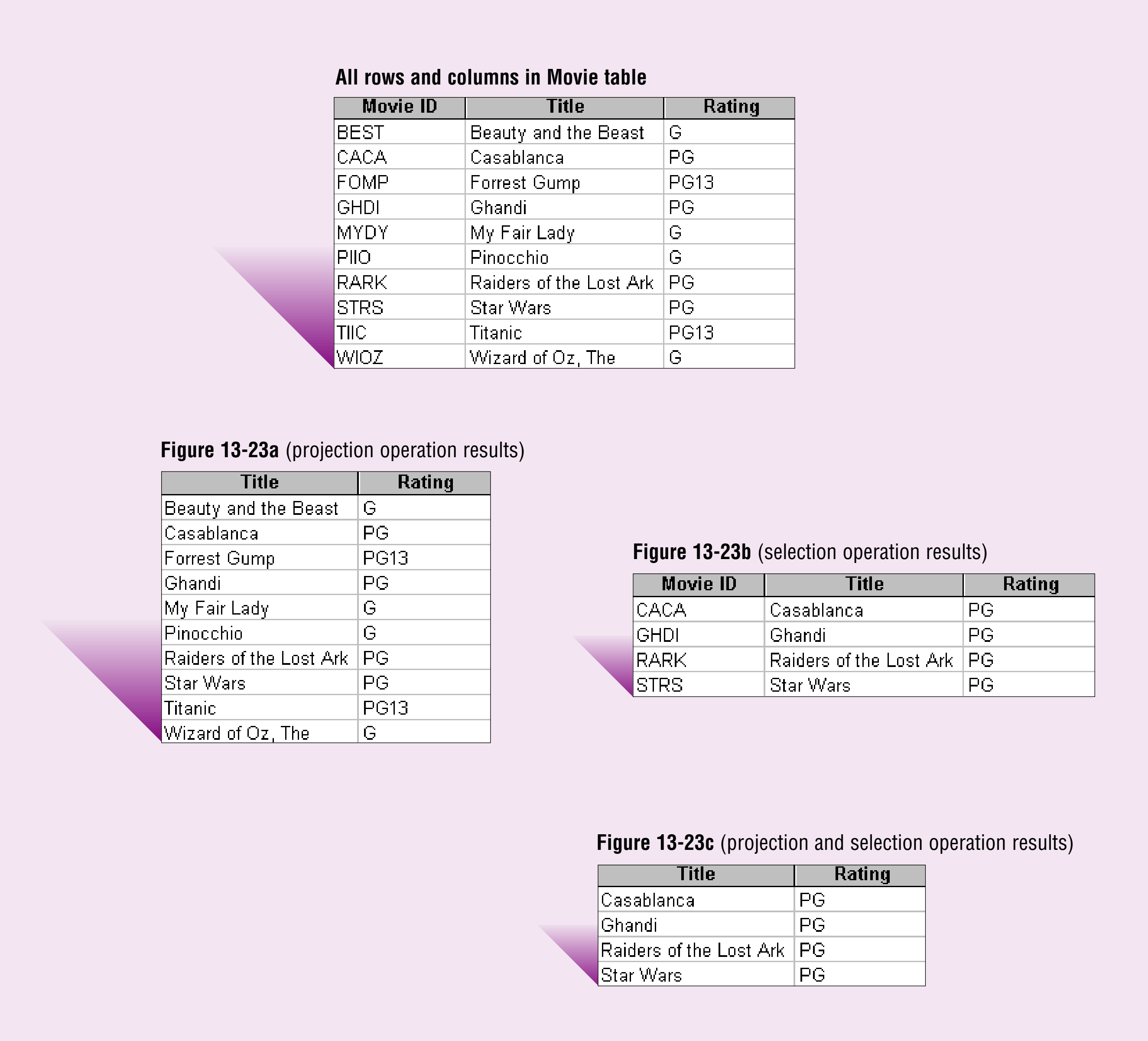
RELATIONAL ALGEBRA Relational databases often manipulate and retrieve data with relational algebra. **Relational algebra** uses variables and operations to build new relations. The variables typically are the tables, rows, and columns of the database. Three of the more common operations are projection, selection, and join.

The **projection operation** retrieves data from columns (fields). That is, it extracts a vertical subset from a table. Figure 13-23a shows the result of a projection operation that retrieves the Title and Rating columns from the Movie table.

The **selection operation** retrieves data from certain rows (records) using the criteria you specify. That is, it extracts a horizontal subset of a table. The selection operation in Figure 13-23b retrieves all rows containing PG in the Rating column of the Movie table.

Users often combine the projection and selection operations. Figure 13-23c shows a projection and selection that lists titles of movies with a PG rating.

The **join operation** combines the data from the two or more tables using a common column. For example, to list the movies due today, you need data from the Rental and Movie tables. The Rental table contains the Due Date and Movie ID columns, and the Movie table contains the Movie ID and Title columns. The join operation uses the Movie ID column to combine



All rows and columns in Movie table

Movie ID	Title	Rating
BEST	Beauty and the Beast	G
CACA	Casablanca	PG
FOMP	Forrest Gump	PG13
GHDI	Ghandi	PG
MYDY	My Fair Lady	G
PIIO	Pinocchio	G
RARK	Raiders of the Lost Ark	PG
STRS	Star Wars	PG
TIIC	Titanic	PG13
WIOZ	Wizard of Oz, The	G

Figure 13-23a (projection operation results)

Title	Rating
Beauty and the Beast	G
Casablanca	PG
Forrest Gump	PG13
Ghandi	PG
My Fair Lady	G
Pinocchio	G
Raiders of the Lost Ark	PG
Star Wars	PG
Titanic	PG13
Wizard of Oz, The	G

Figure 13-23b (selection operation results)

Movie ID	Title	Rating
CACA	Casablanca	PG
GHDI	Ghandi	PG
RARK	Raiders of the Lost Ark	PG
STRS	Star Wars	PG

Figure 13-23c (projection and selection operation results)

Title	Rating
Casablanca	PG
Ghandi	PG
Raiders of the Lost Ark	PG
Star Wars	PG

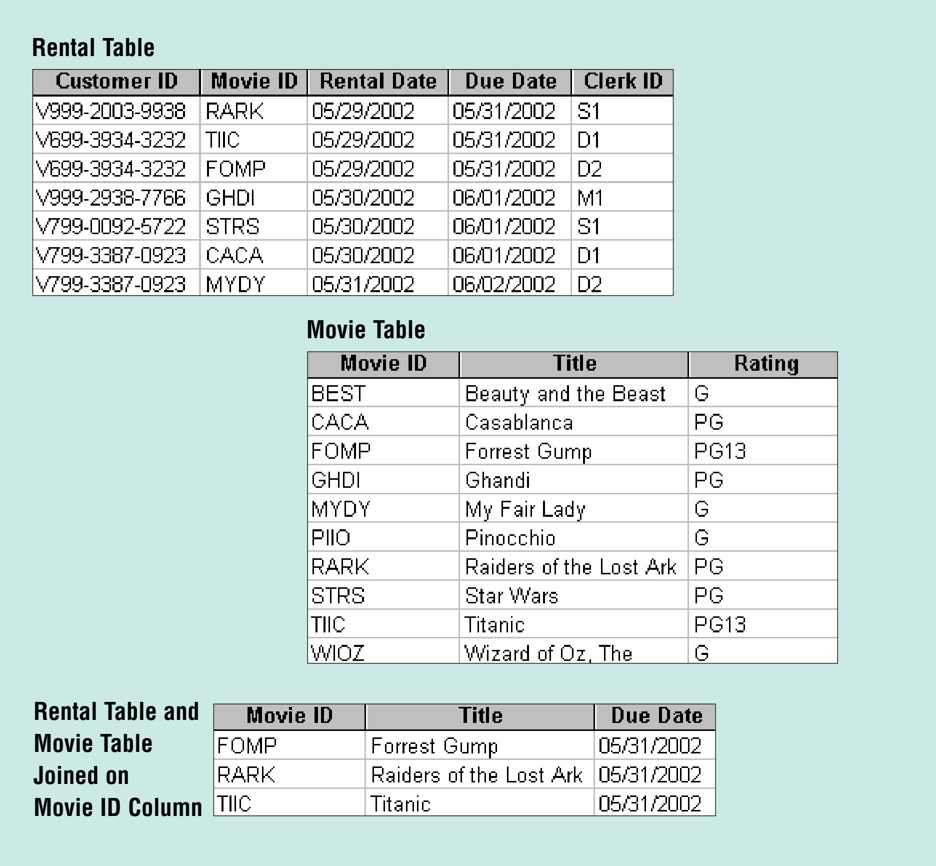
Figure 13-23 The projection and selection operations extract columns and rows from a table respectively.

data from the Rental and the Movie tables. Figure 13-24 shows the results of joining the two tables.

STRUCTURED QUERY LANGUAGE

Structured Query Language (**SQL**) is a query language that allows you to manage, update, and retrieve data. To use relational algebra, SQL has special keywords and rules that you include in SQL statements. For example, the SQL statement in Figure 13-25 shows how to write the join operation that creates the relation shown at the bottom of Figure 13-24. The statement displays the Movie ID, Title, and Due Date fields for all movies due today (05/31/2002).

Most relational database products for minicomputers and mainframes include SQL. Many personal computer databases also include SQL. Chapter 15 covers SQL in more depth.



Rental Table

Customer ID	Movie ID	Rental Date	Due Date	Clerk ID
V999-2003-9938	RARK	05/29/2002	05/31/2002	S1
V699-3934-3232	TIIC	05/29/2002	05/31/2002	D1
V699-3934-3232	FOMP	05/29/2002	05/31/2002	D2
V999-2938-7766	GHDI	05/30/2002	06/01/2002	M1
V799-0092-5722	STRS	05/30/2002	06/01/2002	S1
V799-3387-0923	CACA	05/30/2002	06/01/2002	D1
V799-3387-0923	MYDY	05/31/2002	06/02/2002	D2

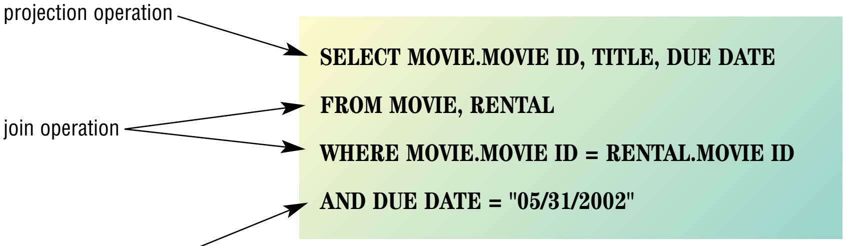
Movie Table

Movie ID	Title	Rating
BEST	Beauty and the Beast	G
CACA	Casablanca	PG
FOMP	Forrest Gump	PG13
GHDI	Ghandi	PG
MYDY	My Fair Lady	G
PIIO	Pinocchio	G
RARK	Raiders of the Lost Ark	PG
STRS	Star Wars	PG
TIIC	Titanic	PG13
WIOZ	Wizard of Oz, The	G

Rental Table and Movie Table Joined on Movie ID Column

Movie ID	Title	Due Date
FOMP	Forrest Gump	05/31/2002
RARK	Raiders of the Lost Ark	05/31/2002
TIIC	Titanic	05/31/2002

Figure 13-24 This join operation displays all movie titles that are due today (05/31/2002).



```
SELECT MOVIE.MOVIE ID, TITLE, DUE DATE
FROM MOVIE, RENTAL
WHERE MOVIE.MOVIE ID = RENTAL.MOVIE ID
AND DUE DATE = "05/31/2002"
```

Figure 13-25 This SQL statement generates the results shown at the bottom of Figure 13-24.

APPLY IT!

Cybersnooping

Are you considering purchasing or selling your home? Would you like to know how much a neighbor paid for her house or obtain details about the floor plan? This information and much more is public record. Until recently, accessing this data meant a trip to the courthouse and laboriously searching through a mountain of records. The Internet is changing this; and in many cities and counties, public records are available online.

Depending on the Web site, you can search by name, address (full address or just the street name), map ID numbers, parcel number, and township range section numbers. Your search may return information such as legal description; date and sales amount; value summary, including market value and assessed value; building information, including year built, square feet, number of bedrooms and baths; and other building structural elements.

Use a natural language search engine, such as AskJeeves, to discover if your city or county public records are available online (see URL below). Your question for AskJeeves may be, Where can I find public records for (name of your county or city)? If this does not work, try substituting property appraiser records for public records. Another resource is BRB Publications. This Web site consists of hundreds of links to county, city, federal, and state Web sites where you can access public record information without charge.

For more information on public records and the Web sites mentioned above, visit the Discovering Computers 2002 Apply It Web page (**scsite.com/dc2002/apply.htm**) and click Chapter 13 Apply It #2.

Web Link

For more information on SQL, visit the Discovering Computers 2002 Chapter 13 WEB LINK page (**scsite.com/dc2002/ch13/weblink.htm**) and click SQL.

Object-Oriented Databases

An **object-oriented database** (**OODB**) stores data in objects. An **object** is an item that can contain both data *and* the activities that read or process the data. A Customer object, for example, might contain data about a customer such as Customer ID, First Name, Last Name, Address, and so on. It also could contain instructions on how to print the customer record or the formula required to calculate a customer's balance due. A record in a relational database, by contrast, would contain *only* data about a customer. Chapter 15 provides a more detailed discussion of object-oriented concepts.

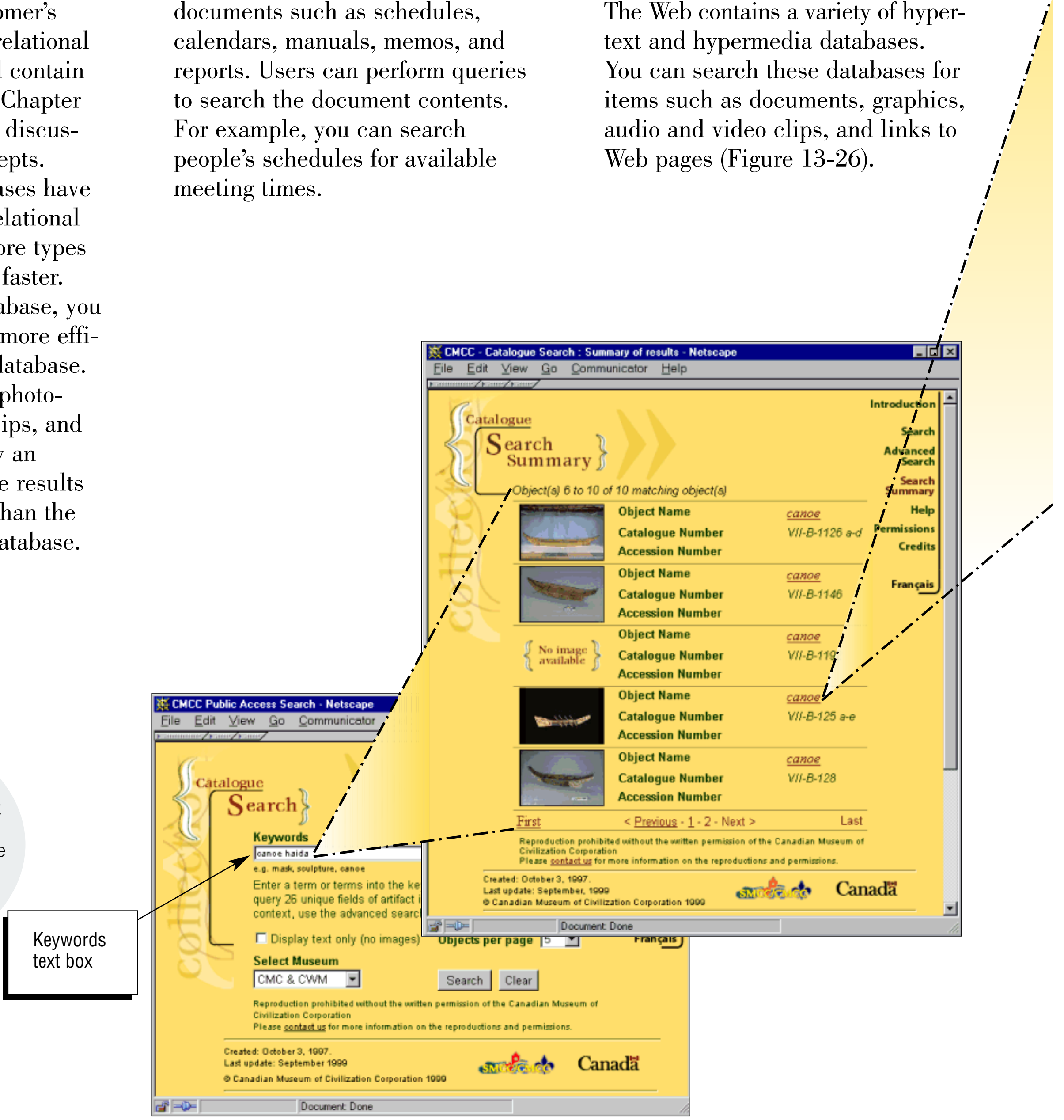
Object-oriented databases have two advantages relative to relational databases: they can store more types of data and access this data faster. With an object-oriented database, you can store unstructured data more efficiently than in a relational database. Unstructured data includes photographs, video clips, audio clips, and documents. When you query an object-oriented database, the results often display more quickly than the same query of a relational database.

Examples of applications appropriate for an object-oriented database include the following:

- **Multimedia databases** store images, audio clips, and/or video clips. For example, a geographic information system (GIS) database stores maps. A voice mail system stores audio messages. A television news station database stores audio and video clips.
- **Groupware databases** store documents such as schedules, calendars, manuals, memos, and reports. Users can perform queries to search the document contents. For example, you can search people's schedules for available meeting times.
- **Computer-aided design** (**CAD**) **databases** store data about engineering, architectural, and scientific designs. Data in the database includes a list of components of the item being designed, the relationship among the components, and previous versions of the design drafts.
- **Hypertext databases** contain text links to other documents. **Hypermedia databases** contain text, graphics, video, and sound. The Web contains a variety of hypertext and hypermedia databases. You can search these databases for items such as documents, graphics, audio and video clips, and links to Web pages (Figure 13-26).

Web Link

For more information on object-oriented databases, visit the Discovering Computers 2002 Chapter 13 WEB LINK page (**scsite.com/dc2002/ch13/weblink.htm**) and click Object-Oriented Databases.



Keywords: canoe haida

e.g. mask, sculpture, canoe

Enter a term or terms into the ke
query 26 unique fields of artifact i
context, use the advanced searc

☐ Display text only (no images)

Objects per page: 5

Select Museum: CMC & CWM

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Created: October 3, 1997.
Last update: September 1999
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Object(s) 6 to 10 of 10 matching object(s)

Object Name	canoe	
Catalogue Number	VII-B-1126 a-d	
Accession Number		
Object Name	canoe	
Catalogue Number	VII-B-1146	
Accession Number		
Object Name	canoe	
Catalogue Number	VII-B-119	
Accession Number		
Object Name	canoe	
Catalogue Number	VII-B-125 a-e	
Accession Number		
Object Name	canoe	
Catalogue Number	VII-B-128	
Accession Number		

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Last update: September, 1999
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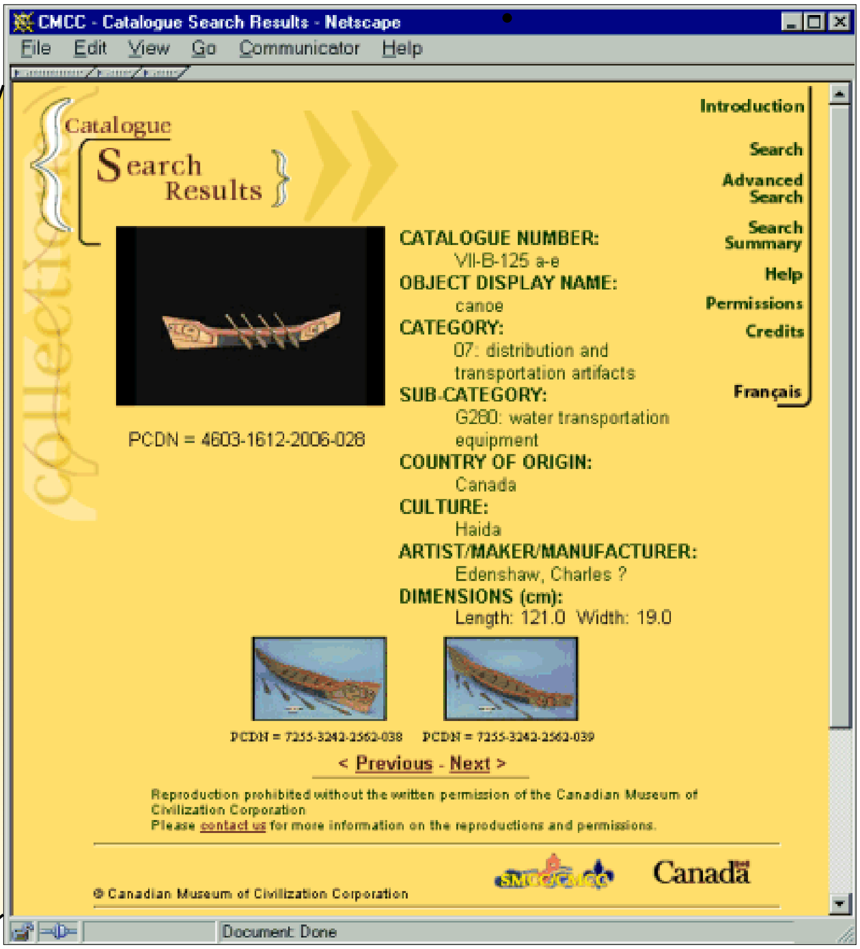
Figure 13-26 This hypermedia database stores museum collections. To display information about a particular artifact, you enter its description in the Keywords text box.



CATALOGUE NUMBER:
VII-B-125 a-e
OBJECT DISPLAY NAME:
canoe
CATEGORY:
07: distribution and transportation artifacts
SUB-CATEGORY:
G280: water transportation equipment
COUNTRY OF ORIGIN:
Canada
CULTURE:
Haida
ARTIST/MAKER/MANUFACTURER:
Edenshaw, Charles ?
DIMENSIONS (cm):
Length: 121.0 Width: 19.0

PCDN = 4603-1612-2006-028

PCDN = 7255-3242-2562-038

PCDN = 7255-3242-2562-039

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- **Web databases** link to an e-form on a Web page. The Web browser sends and receives data between the form and the database. The next page discusses Web databases in more depth.

OBJECT QUERY LANGUAGE Object-oriented and object-relational databases often use a query language called **object query language** (**OQL**) to manipulate and retrieve data. OQL is similar to SQL. OQL and SQL use many of the same rules, grammar, and keywords. Because OQL is a relatively new query language, not all object databases support it.

Multidimensional Databases

A **multidimensional database** (**MDDB**) stores data in dimensions. Whereas a relational database is a two-dimensional table, an MDDB can store more than two dimensions of data. These multiple dimensions, sometimes known as a hypercube, allow users to access and analyze any view of the database data.

A Webmaster at a retailing business may want information on product sales and customer sales for each region spanning a given time period. A manager at the same business may want information on product sales by department for each sales representative spanning a given time period.

An MDDB can consolidate this type of data from multiple dimensions at very high rates of speed. The number of dimensions in an MDDB varies. A retailing business might have four dimensions: products, customers, regions, and time. An MDDB for a hospital procedure could have six dimensions: time, procedure type, patient, hospital, physician, and diagnosis. An MDDB for an insurance policy may include five dimensions: time, policy type, agent, customer, and coverage. Nearly every multidimensional database has a dimension of time. The content of other dimensions varies depending on the subject.

The key advantage of the multidimensional database is that it can consolidate data much faster than a relational database. A relational database typically does not process and summarize large numbers of records efficiently. With a multidimensional database you can obtain summarized results very quickly. For example, a query that takes minutes or hours to execute in a relational database will take only seconds to execute in a multidimensional database.

No standard query language exists for multidimensional databases. Each database uses its own language. Most are similar to SQL.

Web Link

For more information on multidimensional databases, visit the Discovering Computers 2002 Chapter 13 WEB LINK page (**scsite.com/dc2002/ch13/weblink.htm**) and click Multidimensional Databases.

WEB DATABASES

One of the most profound features of the World Wide Web is the vast amount of information it provides. The Web offers information on jobs, travel destinations, television programming, movies and videos at the box office, local and national weather, sporting events, and legislative information (Figure 13-27). You can shop for just about any product or service, buy or sell stocks, search for a job, and make airline reservations. Much of this and other information on the Web exists in databases.

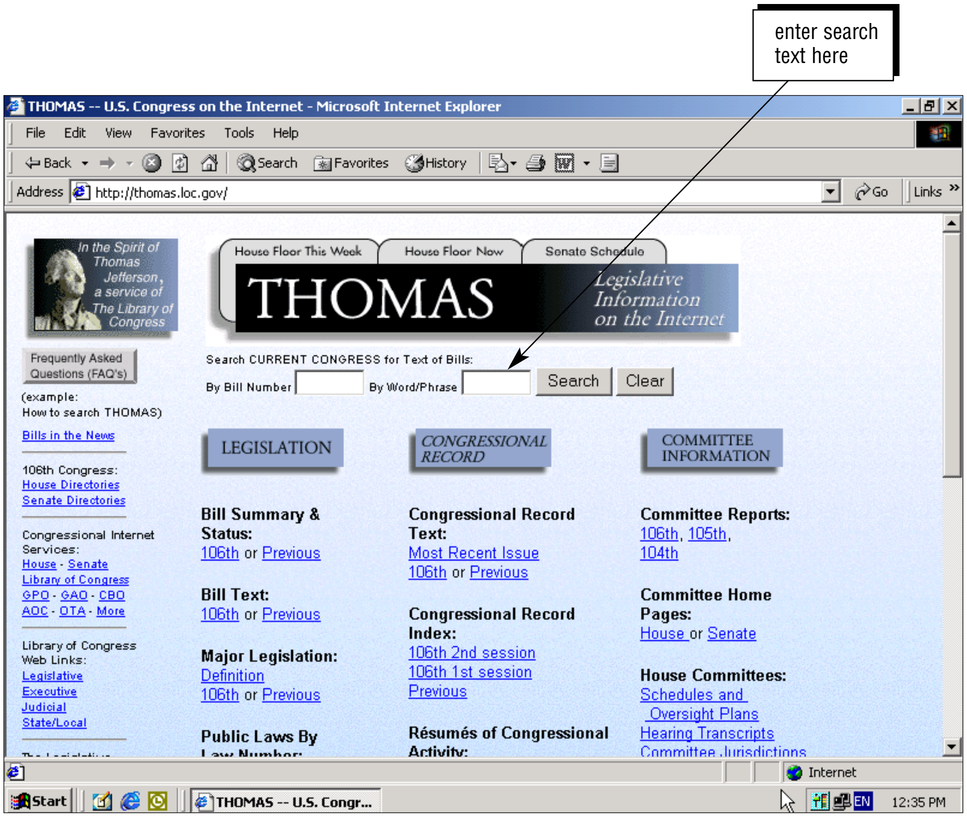

enter search text here

Figure 13-27 Through the THOMAS Web site, you can access a huge database containing congressional bills. To display a list of past and present Congressional bills that deal with Internet privacy, simply enter the text Internet privacy in the By Word/Phrase text box.

To access one of these Web databases, you enter data into a form on a Web page. The Web page is the front end to the database. Many search engines such as Yahoo! use databases to store Web site descriptions. Thus, the search engine's home page is the front end to the database. To access the database, you enter search text into the search engine. The steps in Figure 13-28 illustrate how a search engine might interact with a Web database.

In addition to accessing information, users provide information to Web databases. Many Web sites request you to enter personal information such as your name, address, telephone number, and preferences into an e-form. The database then stores your personal information for future use. A company, for example, may send e-mail messages to certain groups of customers. If you are a frequent flyer, you may receive travel information.

COMPANY ON THE CUTTING EDGE

Switchboard.com

100 Million Addresses at Your Fingertips

When your To-Do list is longer than your homework list for your algebra final exam, you need help. One Internet site may streamline your life: Switchboard.com. From finding the telephone number for the video store down the street to comparison shopping for a new digital camera or getting directions to the company where you have tomorrow's job interview, Switchboard.com connects you to a plethora of consumers, merchants, and advertisers.

Switchboard is among the 50 most popular Internet sites. The site receives more than 50-million hits monthly from people querying its telephone number and address directories of the nearly 100-million people, 12-million businesses, and 4-million U.S. e-mail addresses.

Founded in 1995, Switchboard rapidly became successful by being the first to market a free, national directory of U.S. residential information. Previously, most people had access only to their local telephone directories. Switchboard continued to connect people, helping organize busy lives. In 1998, Switchboard acquired Maps On Us, an award-winning site providing interactive maps and driving directions.

For more information on Switchboard, visit the Discovering Computers 2002 Companies Web page (**scsite.com/dc2002/companies.htm**) and click Switchboard.

"CBS" and the CBS Eye Device are registered trademarks of CBS Broadcasting Inc. Switchboard is a registered service mark of Switchboard Inc.

A Web database typically resides on a database server. A **database server** is a computer that stores and provides access to the database. One type of program that manages the sending and receiving of data between the front end and the database server is a **CGI (Common Gateway Interface) script**. CGI scripts run automatically — as soon as you click the button to send or receive information. Writing a CGI script requires computer programming skills. Chapter 15 discusses CGI scripts in more detail.

For smaller databases, many personal computer database products provide Web publishing tools. Microsoft FrontPage 2000, for example, has a Database Results Wizard that requires no computer programming. The Wizard publishes a Web page that links to your existing database such as a Microsoft Access or Oracle database.

APPLY IT!

The Ultimate Movie Web Database

The Internet has a wealth of data for the movie enthusiast — literally hundreds of thousands of Web sites devoted to this industry. These Web sites provide an entertaining setting with links to movies of the week, reviews by critics and other movie-goers, celebrity information, and just about any other movie facts or trivia you may want to know. Not only do many of these Web sites tell you the plot of a movie, some even can suggest a film based on your likes and dislikes.

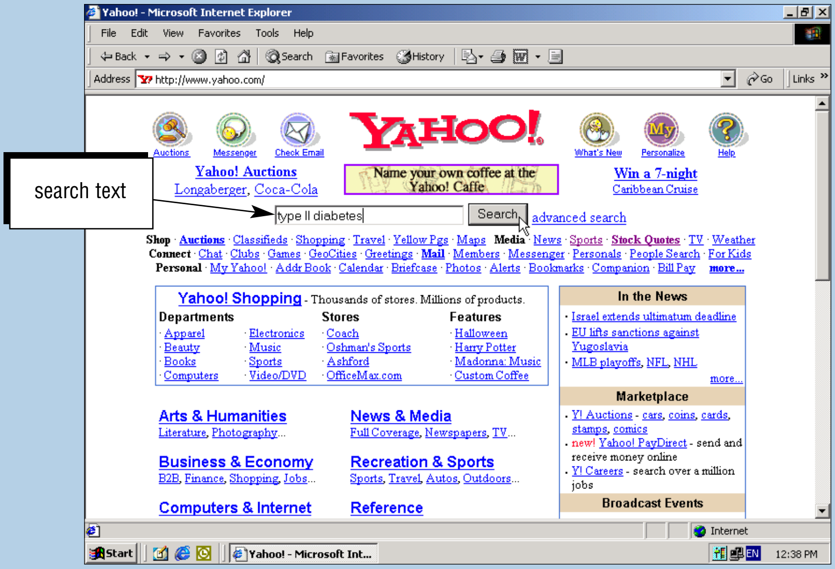
The Internet Movie Database is considered by many as the ultimate movie reference database (see URL below). Movies.com is another favorite online locale for many movie buffs. This Web site, owned by Disney, provides movie show times for all major cities. Usually by entering your postal code, you can view a list of nearby theaters and movie times. While visiting these Web sites, you can view a variety of trailers or movie clips. You will need the RealPlayer or Windows Media Player plug-ins to enjoy these.

For more information on movie databases and the Web sites mentioned above, visit the Discovering Computers 2002 Apply It Web page (**scsite.com/dc2002/apply.htm**) and click Chapter 13 Apply It #3.

Figure 13-28 HOW A SEARCH ENGINE MIGHT INTERACT WITH A WEB DATABASE

Step 1:

The browser sends your search text to the Web server.



http://www.yahoo.com/

Yahoo! Auctions
Longaberger, Coca-Cola

Name your own coffee at the Yahoo! Caffe

Win a 7-night
Caribbean Cruise

type II diabetes

advanced search

Shop · Auctions · Classifieds · Shopping · Travel · Yellow Pgs · Maps **Media** · News · Sports · Stock Quotes · TV · Weather
Connect · Chat · Clubs · Games · GeoCities · Greetings · Mail · Members · Messenger · Personals · People Search · For Kids
Personal · My Yahoo! · Addr Book · Calendar · Briefcase · Photos · Alerts · Bookmarks · Companion · Bill Pay **more...**

Yahoo! Shopping - Thousands of stores. Millions of products.

Departments		Stores	Features
· Apparel	· Electronics	· Coach	· Halloween
· Beauty	· Music	· Oshman's Sports	· Harry Potter
· Books	· Sports	· Ashford	· Madonna: Music
· Computers	· Video/DVD	· OfficeMax.com	· Custom Coffee

In the News
- Israel extends ultimatum deadline
- EU lifts sanctions against Yugoslavia
- MLB playoffs, NFL, NHL

more...

Marketplace
- Y! Auctions - cars, coins, cards, stamps, comics
- new! Yahoo! PayDirect - send and receive money online
- Y! Careers - search over a million jobs

Broadcast Events

Arts & Humanities
Literature, Photography...

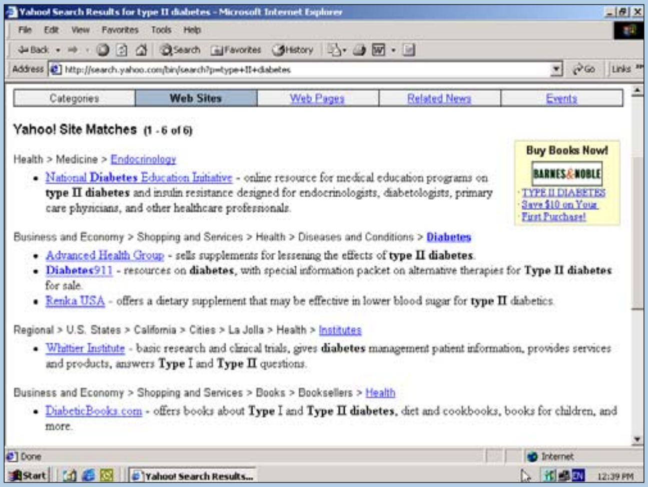
News & Media
Full Coverage, Newspapers, TV...

Business & Economy
B2B, Finance, Shopping, Jobs...

Recreation & Sports
Sports, Travel, Autos, Outdoors...

Computers & Internet

Reference



http://search.yahoo.com/bin/search?p=type+II+diabetes

Yahoo! Site Matches (1 - 6 of 6)

Buy Books Now!
BARNES&NOBLE
· TYPE II DIABETES
· Save $10 on Your First Purchase!

Health > Medicine > Endocrinology
- National **Diabetes** Education Initiative - online resource for medical education programs on **type II diabetes** and insulin resistance designed for endocrinologists, diabetologists, primary care physicians, and other healthcare professionals.

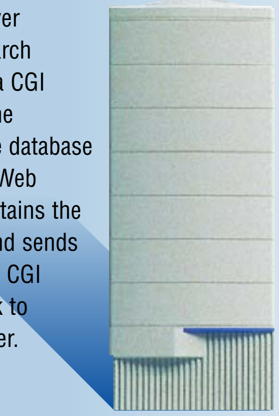
Business and Economy > Shopping and Services > Health > Diseases and Conditions > **Diabetes**
- Advanced Health Group - sells supplements for lessening the effects of **type II diabetes**.
- **Diabetes**911 - resources on **diabetes**, with special information packet on alternative therapies for **Type II diabetes** for sale.
- Renka USA - offers a dietary supplement that may be effective in lower blood sugar for **type II** diabetics.

Regional > U.S. States > California > Cities > La Jolla > Health > Institutes
- Whittier Institute - basic research and clinical trials, gives **diabetes** management patient information, provides services and products, answers **Type** I and **Type II** questions.

Business and Economy > Shopping and Services > Books > Booksellers > Health
- DiabeticBooks.com - offers books about **Type** I and **Type II diabetes**, diet and cookbooks, books for children, and more.

Step 2:

The Web server sends the search text through a CGI program to the database. The database retrieves the Web page that contains the search text and sends it through the CGI program back to the Web server.



Web server

Step 3:

The Web server sends the Web page to the browser.

DATABASE ADMINISTRATION

Managing a company's database requires a great deal of coordination. The role of coordinating the use of the database belongs to the database analysts and administrators. To carry out their responsibilities, these IT professionals need cooperation from all database users.

Role of the Database Analysts and Administrators

The database analysts and administrators are responsible for managing and coordinating all database activities. The **database analyst** (**DA**), or **data modeler**, focuses on the meaning and usage of data. The DA decides on the proper placement of fields, defines relationships among data, and identifies users' access privileges. The **database administrator** (**DBA**) requires a more technical inside view of the data. The DBA creates and maintains the data dictionary, manages security of the database, monitors the performance of the database, and checks backup and recovery procedures.

In small companies, one person often is both the database analyst and administrator. In larger companies, the responsibilities of the database analyst and administrator are split among two or more persons.

Web Link

For more information on database administrators, visit the Discovering Computers 2002 Chapter 13 WEB LINK page (**scsite.com/dc2002/ch13/weblink.htm**) and click Database Administrators.

Role of the Employee as a User

Employees should learn how to utilize the data in the database. The amount of information available often amazes first-time database users. Instant access to this information helps employees perform their jobs more effectively. For example, assume a car backed into your parked car. You call your insurance agent to find out where to repair your car. She instantly reads to you a list of authorized car repair shops in your area. Today, employees such as the insurance agent can access databases from their office desktop computer, a notebook computer, or even a Web-enabled device such as a cellular telephone.

Employees also must take an active role in identifying new data for the database. For example, maybe the insurance agent cannot access a list of car repair shops on the computer. Instead, she looks them up in the telephone book. The agent's job would be much easier if this information was available on the computer.

The maintenance of a database is an ongoing task companies measure constantly against their overall goals. Users can take part in designing the database that will help them achieve those goals. Chapter 14 discusses the role of the user in system development, which includes the design of the database.

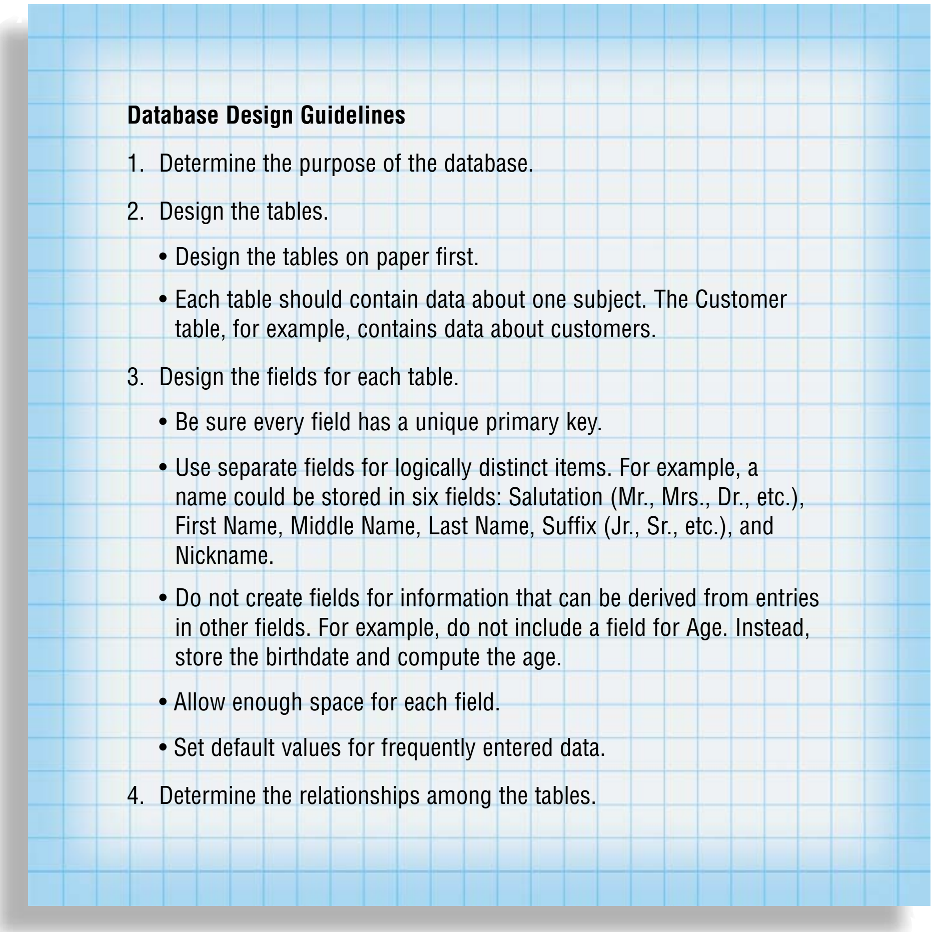
Database Design Guidelines

A carefully designed database makes it easier for a user to query the database, modify the data, and create reports. The guidelines shown in Figure 13-29 apply to databases of all sizes.

QUALITIES OF VALUABLE INFORMATION

As with data, information includes certain characteristics to make it valuable. The characteristics of **valuable information** include being accurate, verifiable, timely, organized, useful, accessible, and cost effective.

- **Accurate information** is correct information. Incorrect information can lead to incorrect decisions. People, for example, assume their credit report is right. If your credit report incorrectly shows you have past due payments, a bank may not give you a car loan.
- **Verifiable** means you can prove the information is correct or incorrect. For example, before relying on employer information in your credit report, a loan officer may want copies of your last three pay stubs.
- **Timely information** has an age suited to its use. Your credit report, for example, has value to a loan officer only if the bank receives it in time to make a loan decision. Most information loses its value with time. Some information, such as information on trends, gains value as time passes and more information is obtained. Your credit report gains value as you accumulate more credit. A credit report that shows three years of payment history has more meaning than one showing just six months.
- **Organized information** is arranged to suit your needs and requirements. Two different people may want the same information



Database Design Guidelines

1. Determine the purpose of the database.
2. Design the tables.
    - Design the tables on paper first.
    - Each table should contain data about one subject. The Customer table, for example, contains data about customers.
3. Design the fields for each table.
    - Be sure every field has a unique primary key.
    - Use separate fields for logically distinct items. For example, a name could be stored in six fields: Salutation (Mr., Mrs., Dr., etc.), First Name, Middle Name, Last Name, Suffix (Jr., Sr., etc.), and Nickname.
    - Do not create fields for information that can be derived from entries in other fields. For example, do not include a field for Age. Instead, store the birthdate and compute the age.
    - Allow enough space for each field.
    - Set default values for frequently entered data.
4. Determine the relationships among the tables.

Figure 13-29 Guidelines for developing a database.

presented in a different manner. For example, a loan officer may want a credit report to list most recent debts first. You may want your credit report alphabetized by creditor name.

- **Useful information** has meaning to the person who receives it. Most information is important only to certain people or groups of people. Thus, always consider the audience when you are collecting and reporting information. Avoid distributing useless information. A loan officer probably does not need information about your high school grades.
- **Accessible information** is available when you need it. Waiting for information may delay important decisions. If information is not available, people may make incorrect decisions because they are unaware of certain facts. The longer it takes your credit report to arrive, the longer you have to wait for a loan.
- **Cost-effective information** costs less to produce than the value of the resulting information. A company occasionally should review the information it produces. Is it still useful? Based on the answer, the company determines whether to continue, scale back, or even stop distributing the information.

Sometimes, it is not easy to place a value on information. For this reason, some companies create information only as people request it, instead of on a regular basis. Many companies make the information available online. Users then can access and print online information as they need it.

ISSUE

Free Online Service

Accessibility of College Scholarship Information

If you need help with college costs, consider scholarships. Many students think scholarships are available only for financial aid or high grade point averages, so they do not consider this option. You may be surprised to know that thousands of scholarships are available within many other categories. Free online services may be able to help you locate those that match your qualifications, plans, and chosen schools. When you register, the online service queries a database containing thousands of suitable scholarships and then returns the results. Ironically, those least likely to benefit from this service may be those who need it most. Because students from less affluent backgrounds usually have less computer experience, they may be unaware of, or unable to access, the scholarship search services. How can these free Web services be made more universally available? Who do you think should assume the leading role in extending access to these services, and why? Not all services may be legitimate, so how can you avoid scholarship scams?

For more information on scholarships, visit the Discovering Computers 2002 Issues Web page (**scsite.com/dc2002/issues.htm**) and click Chapter 13 Issue #3.

How Managers Use Information

All employees, including managers, in a company need correct information to perform their jobs effectively. **Managers** are responsible for coordinating the use of resources. Resources include people, money, materials, and information. Managers coordinate these resources by performing four activities: planning, organizing, leading, and controlling.

- **Planning** involves establishing goals and objectives. It also includes deciding on the strategies needed to meet these goals and objectives.
- **Organizing** includes identifying and combining resources so that the company can reach its goals and objectives. Organizing also involves setting up the management structure of a company, such as the departments and reporting relationships.
- **Leading**, sometimes referred to as directing, involves instructing and authorizing others to perform the necessary work.
- **Controlling** involves measuring performance and, if necessary, taking corrective action.

Figure 13-30 shows how these four management activities usually occur in an order that forms an endless cycle. During the controlling activity, managers measure actual performance against a previously established plan. Following this measurement, they may revise the plan. Revised plans may result in additional organizational and leadership activities. Managers then measure performance against the revised plan, and the cycle repeats itself. The four tasks are linked. A change in one task usually affects one or more of the other tasks.

Levels of Users

The types of information you need often depend on your employee level in the company. Users typically fall into one of four categories: executive management, middle management, operational management, and nonmanagement employees (Figure 13-31).

EXECUTIVE MANAGEMENT

Executive management, also referred to as senior management or top management, includes the highest management positions in a company. These managers focus on the long-range direction of the company. They primarily are responsible for **strategic decisions** that focus on the company's overall goals and objectives. Executive management oversees middle management.

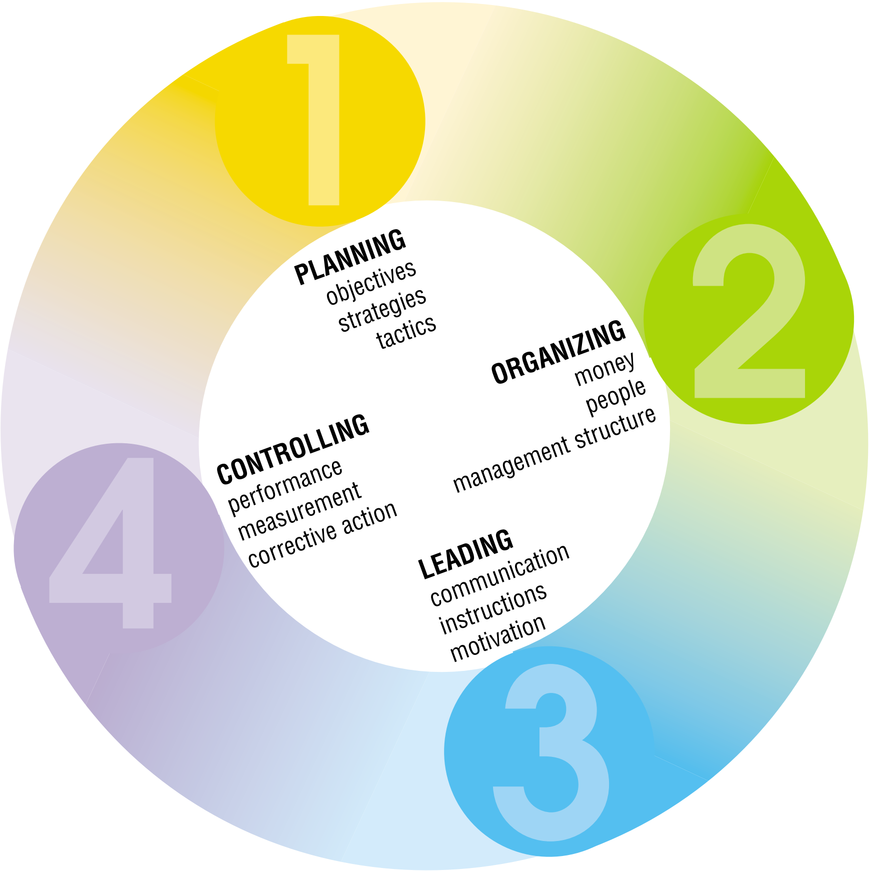


Figure 13-30 The four management activities include planning, organizing, leading, and controlling. They usually are performed in a continuous sequence.

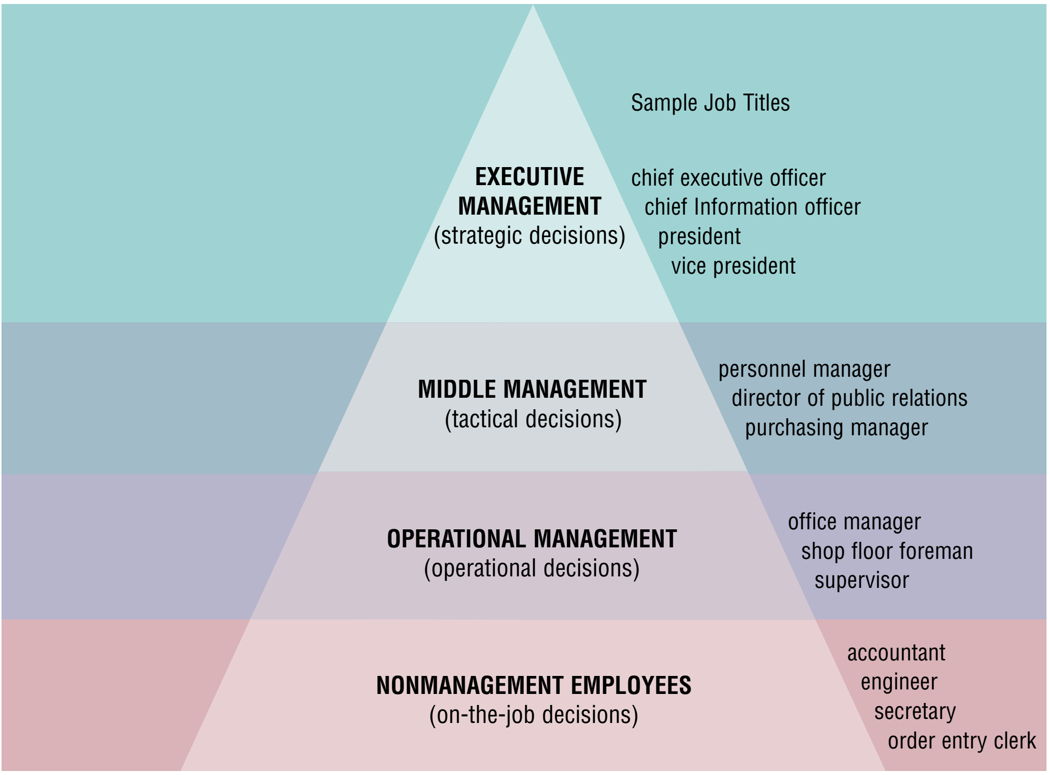


Figure 13-31 The information requirements of a user often depend on the user's level in the company. This pyramid illustrates the levels of users, sample job titles of each level of user, and the types of decisions these users make.

MIDDLE MANAGEMENT

Middle management is responsible for implementing the strategic decisions of executive management. Middle managers do this by making tactical decisions. A **tactical decision**, also called a **short-range decision**, applies specific programs and plans necessary to meet the stated objectives. Middle management oversees operational management.

OPERATIONAL MANAGEMENT

Operational management supervises the production, clerical, and other nonmanagement employees of a company. In performing their duties, operational managers make operational decisions. An **operational decision** involves day-to-day activities within the company. These decisions should be consistent with and support the tactical decisions made by middle management.

NONMANAGEMENT EMPLOYEES

Nonmanagement employees include production, clerical, and staff personnel. Nonmanagement employees also frequently need information to perform their jobs. Today, these employees have more information available to them than in the past. They have access to the information necessary to make decisions that previously were made by managers — a trend called **empowering** users.

TECHNOLOGY TRAILBLAZER

LARRY **ELLISON**

Oracle chairman and co-founder Larry Ellison is a larger-than-life presence in today's software industry. His strong point is his uncanny ability to motivate his employees and partners toward a common vision.

As a young man, Ellison was interested in science and mathematics but lacked enthusiasm for school. Difficult technical problems, however, sparked his interest and motivated him. In 1976, he learned about relational database theory. Relational databases were powerful and easy to use, but industry experts believed they were too slow to be commercially feasible.

Ellison accepted the challenge. He set out to develop a commercially viable relational database. Then, in 1977, with three co-founders, Ellison started Oracle Corporation. When the Oracle relational database was released, it was an immediate success.

Today, Oracle is the world's leading provider of software for e-business. With a passion to become the new custodian of cyberspace, Ellison's goal is to grow Oracle into the largest software company in the world. Although eccentric and flamboyant, he never has been called boring.

For more information on Larry Ellison, visit the Discovering Computers 2002 People Web page (**scsite.com/dc2002/people.htm**) and click Larry Ellison.

TYPES OF INFORMATION SYSTEMS

An **information system** is a set of hardware, software, data, people, and procedures that work together to produce information (Figure 13-32). A **procedure** is an instruction, or set of instructions, a user follows to accomplish an activity. An information system supports daily, short-term, and long-range activities of users in a company.

Information systems generally fall into one of five categories: office information systems, transaction processing systems, management information systems, decision support systems, and expert systems. The following sections present each type of information system.

Office Information Systems

An **office information system** (**OIS** pronounced oh-eye-ess) increases employee productivity and assists with communications among employees. In an OIS, employees perform tasks using computers and other electronic devices, instead of manually. Some people describe an OIS as **office automation**.

Just about every type of business or organization uses some form of OIS. For example, a school might post its class schedules on the Internet. When the school updates the schedule, students receive an e-mail notification. In a manual system, the school would photocopy the schedule and mail it to each student's house.

An OIS supports many office activities. With an OIS, you can create and distribute graphics and documents, send messages, schedule appointments, browse the Web, and publish Web pages. All levels of users utilize and benefit from the features of an OIS.

An OIS uses many common software products to support its activities. Typical software in an OIS includes word processing, spreadsheet, database, presentation graphics, e-mail, Web browser, Web page authoring, personal information management, and groupware. To send text, graphics, audio, and video to others, an OIS uses communications technology such as voice mail, fax, videoconferencing, and electronic data interchange (EDI).

In an OIS, computers have modems, video cameras, speakers, and microphones. Scanners, fax machines, digital cameras, and Web-enabled devices such as cellular telephones are other types of hardware often found in an OIS.

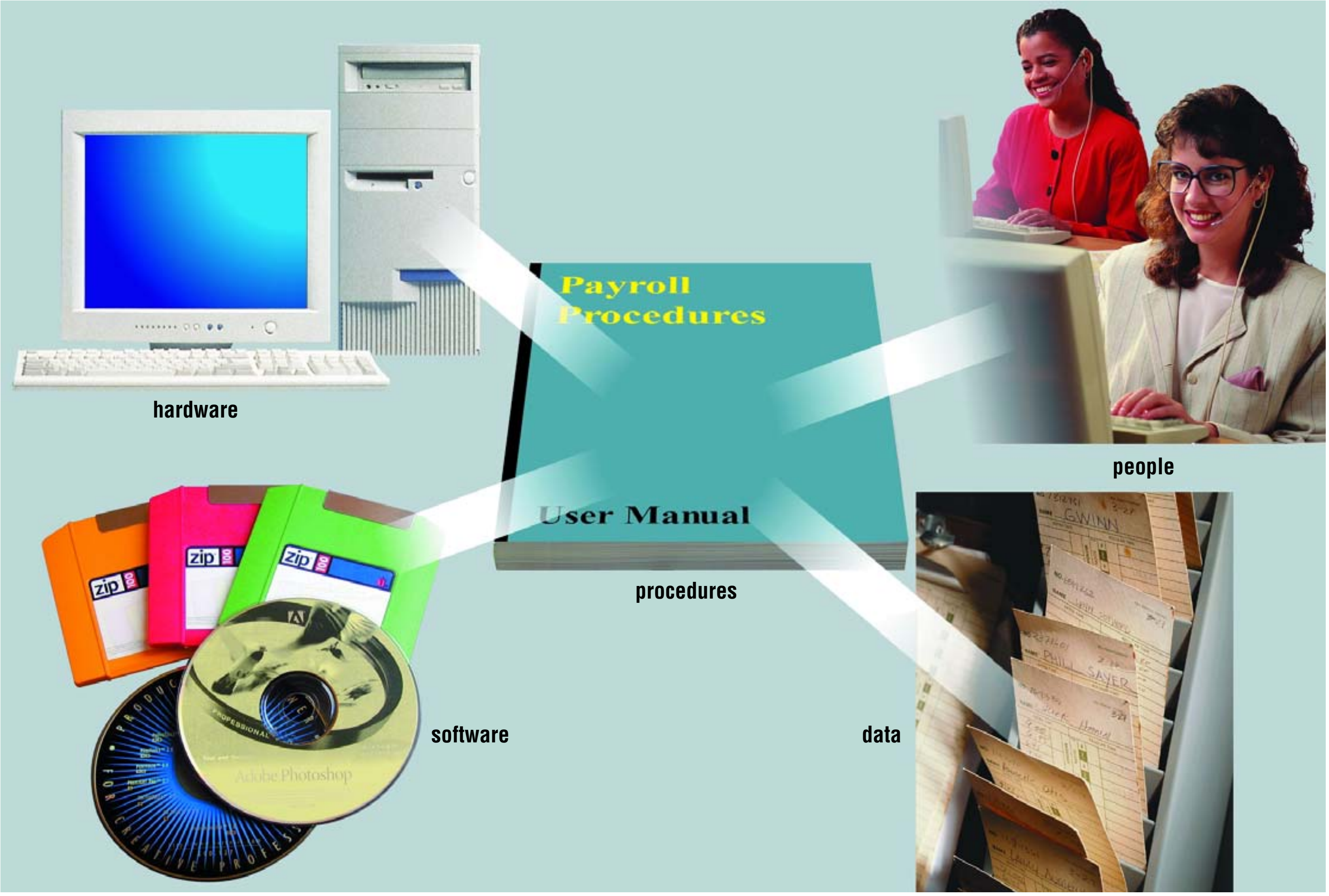


Figure 13-32 An information system typically contains five components: hardware, software, data, people, and procedures.

Transaction Processing Systems

A **transaction processing system** (**TPS**) captures and processes data from day-to-day business activities. When you use an automated teller machine to withdraw cash, you are using a TPS (Figure 13-33). Examples of transactions are deposits, payments, orders, and reservations. In a company, clerical staff typically perform the activities associated with a TPS, which include the following:

1. Recording a business activity such as a student's registration, a customer's order, an employee's timecard, or a car owner's payment
2. Confirming an action or causing a response, such as printing a student's schedule, sending a thank-you note to a customer, printing an employee's paycheck, or issuing a receipt to a car owner
3. Maintaining data, which involves adding new data, changing existing data, or removing unwanted data

Transaction processing systems were among the first computerized systems that processed business data. Many people initially referred to the functions of a TPS as **data processing**. The first TPSs computerized an existing manual system. The intent of these TPSs was to process faster, reduce clerical costs, and improve customer service.

The first TPSs mostly used batch processing. With **batch processing**, the computer collects data over a period of time and processes all transactions later, as a group. As computers became more powerful, system developers created online transaction processing systems. With **online transaction processing** (**OLTP**), the computer processes each transaction as it is entered.

When you register for classes, your school probably uses OLTP. The registration clerk enters your desired schedule. The computer immediately prints your statement of classes. The invoices often are printed using batch processing. That is, the computer prints and mails all student invoices at a later date.

Today, most transaction processing systems use OLTP. For some routine processing tasks, they also use batch processing. Many organizations use batch processing to calculate paychecks and print invoices.

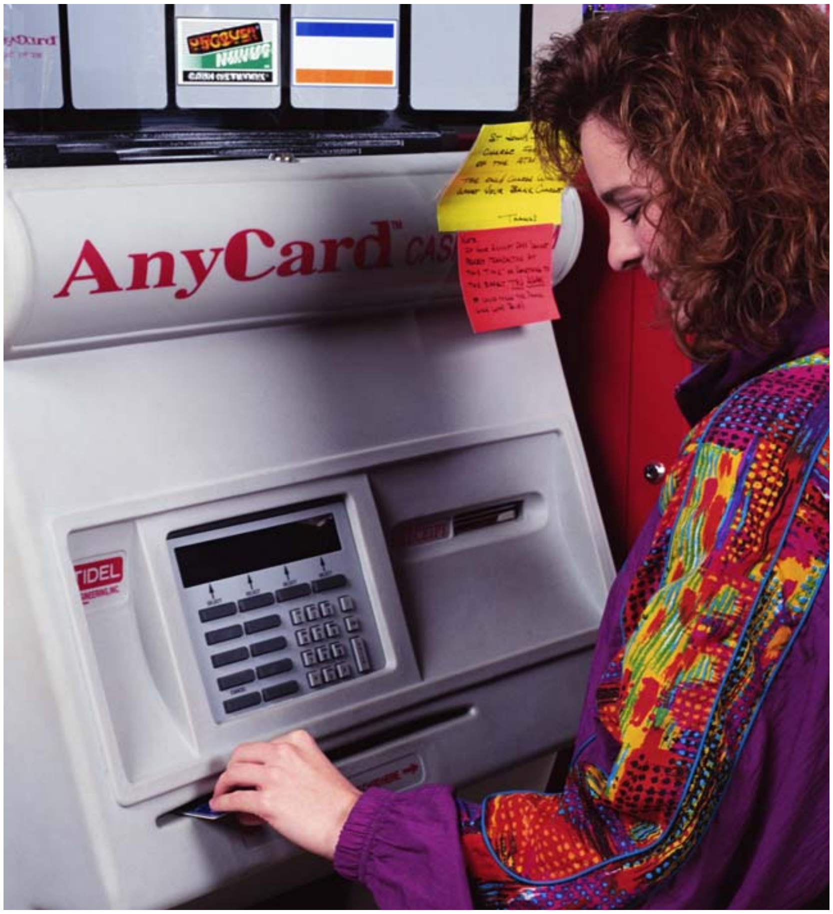


Figure 13-33 When you use an ATM to deposit or withdraw money, you are using a transaction processing system.

Management Information Systems

A **management information system** (**MIS** pronounced em-eye-ess) generates accurate, timely, and organized information, so managers and other users can make decisions, solve problems, supervise activities, and track progress. Management information systems evolved from transaction processing systems. Managers realized the computer had more potential than just supporting a TPS. Its capability of quick computing and data comparisons could produce meaningful information for managers.

MISs often are integrated with transaction processing systems. To process a sales order the TPS records the sale, updates the customer's account balance, and reduces the inventory count. Using this information, the related MIS can produce reports that recap daily sales activities; summarize weekly and monthly sales activities; list customers with past due account balances; graph slow or fast selling products; and highlight inventory items that need reordering. An MIS focuses on creating information that managers and other users need to perform their jobs.

An MIS creates three basic types of information: detailed, summary, and exception (Figure 13-34). A **detailed report** usually just lists transactions. For example, a Detailed Order Report lists orders taken during a given time period. A **summary report** consolidates data, so you can review it quickly and easily. A summary report usually has totals, tables, or graphs.

Figure 13-34a (detailed report)

DETAILED ORDER REPORT for May 21, 2002

Part Number	Part Description	Customer	Quantity Purchased
1788	stapler	Starlight Foods	15
		Wilson Automotive	40
		Victor Lighting	13
2372	postage scale	Regal Camera	1
		Wilson Automotive	4
3029	letter opener	AAA Rentals	25
		Starlight Foods	10
8942	bulletin board	Wilson Automotive	8

Figure 13-34b (summary report)

DETAILED SUMMARY REPORT for May 21, 2002
by Part Number

Part Number	Part Description	Total Quantity Sold	Vendor
1788	stapler	68	Geo Supplies
2372	postage scale	5	Marham Industries
3029	letter opener	35	Geo Supplies
8942	bulletin board	8	Geo Supplies

Inventory Summary

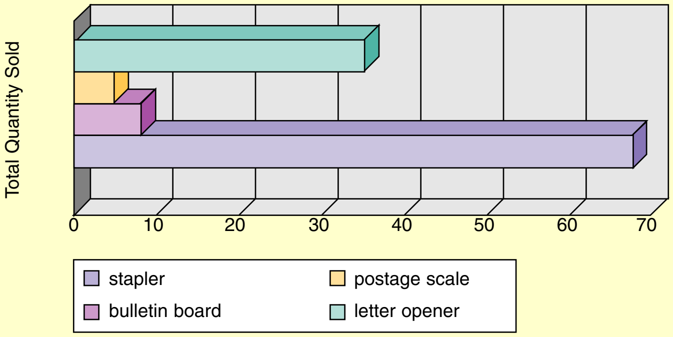


Figure 13-34c (exception report)

INVENTORY EXCEPTION REPORT for May 21, 2002

Part Number	Part Description	Total Quantity on Hand	Reorder Point
8942	bulletin board	228	240
3029	letter opener	558	560

Figure 13-34 Three basic types of information generated in an MIS are detailed, summary, and exception.

An **exception report** identifies data outside of a normal condition. These conditions, called the **exception criteria**, define the normal activity or status range. For example, an Inventory Exception Report notifies the purchasing department of items it needs to reorder.

Exception reports save managers time. Instead of searching through a detailed report, managers simply review the exception report. These reports help managers focus on situations that require immediate decisions or actions.

Decision Support Systems

A **decision support system** (**DSS**) helps you analyze data and make decisions. Often, a TPS or MIS does not generate the type of report a manager needs to make a decision. Different managers need various types of information. A marketing manager might need to know how much he or she has spent on Internet advertising in the past three months. Whereas an office manager might need to know how many pads of paper were used.

A variety of DSSs exist. Some are company specific and used by managers. Others are available to everyone on the Web. Programs that analyze data, such as those in a DSS, sometimes are called **online analytical processing** (**OLAP**) applications. Because they summarize information, these applications process many records at a time. This is different from OLTP applications, which process individual records at one time and typically use relational databases.

Some OLAP applications are called **MOLAP** because they use multidimensional databases. Those that use relational databases are known as **ROLAP**. Others blend the two database types. These hybrid OLAPs may use an ROLAP as the back end and an MOLAP as the front end.

A DSS uses data from internal and external sources. **Internal sources** of data might include sales, manufacturing, inventory, or financial data from a company's database. Data from **external sources** could include interest rates, population trends, costs of new housing construction, or raw material pricing.

Some DSSs have their own query languages, statistical analysis, spreadsheets, and graphics that help you retrieve data and analyze the results. Some also allow you to create a model of the factors affecting a decision. A product manager might need to decide on a price for a new product. A simple model for finding the best price would include factors for the expected sales volume at various price levels. The model allows you to ask what-if questions and view the expected results.

Instead of buying a DSS, many people use their application software to perform DSS functions. With Microsoft Excel, for example, you can model data and create what-if scenarios.

ISSUE

Tracking Buyers' Habits

Reporting Music and Book Sales Information

SoundScan turned the music world upside down — now we have BookScan. SoundScan is a database that tracks sales of music and music video products throughout the United States. When the sales clerk scanned the barcode on the new CD you just purchased, that data went directly into the SoundScan database. Sales data from the Billboard 200 Chart is compiled using SoundScan. CMT, MTV, and VH1 all use SoundScan data. The publishing industry now is applying this same technique by using BookScan. The goal is to make a similar impact on the publishing industry. If publishers and vendors use BookScan, will they base all decisions on sales figures? Book titles that slowly gain recognition through time may never be given a chance and new artists and authors may be ignored. Overall, do you think these databases have a positive or negative effect on publishers? Do they have an effect on authors and readers or retailers and musicians? Why or why not? What are potential disadvantages and how do you think they could be addressed?

For more information on SoundScan and BookScan, visit the Discovering Computers 2002 Issues Web page (**scsite.com/dc2002/issues.htm**) and click Chapter 13 Issue #4.

Web Link

For more information on decision support systems, visit the Discovering Computers 2002 Chapter 13 WEB LINK page (**scsite.com/dc2002/ch13/weblink.htm**) and click Decision Support Systems.

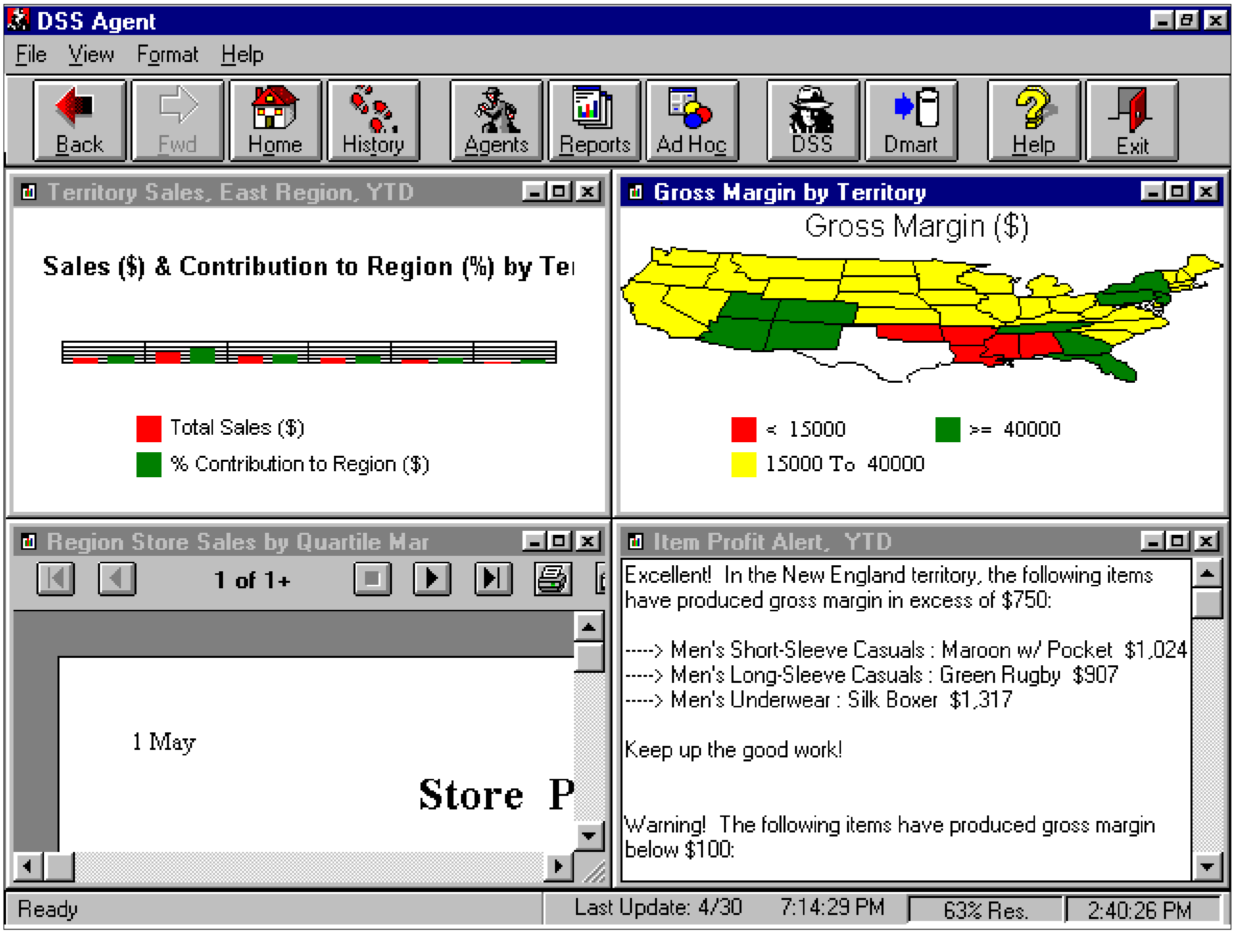
A special type of DSS, called an **executive information system** (**EIS**), supports the strategic information needs of executive management. An EIS presents information as charts and tables that show trends, ratios, and statistics (Figure 13-35). EISs typically use external data sources such as the Dow Jones News/Retrieval Service or the Internet. These external data sources can provide current information on interest rates, commodity prices, and other leading economic indicators.

Data Warehouses

A **data warehouse** is a huge database system that stores and manages the data required to analyze historical and current transactions. Through a data warehouse, managers and other users can access transactions and summaries of transactions quickly and efficiently. Some major credit card companies monitor and manage customers' credit card transactions using a data warehouse. Additionally, consumers can access their own transactions in the data warehouse via the Web. A data warehouse typically has a user-friendly interface, so users easily can interact with its data.

Web Link

For more information on data warehouses, visit the Discovering Computers 2002 Chapter 13 WEB LINK page (**scsite.com/dc2002/ch13/weblink.htm**) and click Data Warehouses.



Excellent! In the New England territory, the following items have produced gross margin in excess of $750:

----> Men's Short-Sleeve Casuals : Maroon w/ Pocket $1,024
----> Men's Long-Sleeve Casuals : Green Rugby $907
----> Men's Underwear : Silk Boxer $1,317

Keep up the good work!

Warning! The following items have produced gross margin below $100:

Figure 13-35 This EIS from MicroStrategy presents information to senior management in the form of graphics and reports.

Most data warehouses include one or more databases and one or more sources. The data in the databases consists of transaction data required for decision making. This data may come from internal or external sources (Figure 13-36). Some data warehouses use Web farming for their external data. **Web farming** is the process of collecting data from the Internet as a source for the data warehouse. With Web resources, the company must convert the data to a form suitable for the data warehouse.

Another growing external source of information is a click stream. A **click stream** is a collection of every action that users make as they move through a Web site. By analyzing visitors' click streams, companies can identify consumer preferences and determine which Web pages are most attractive to visitors.

The data in a data warehouse is accurate as of a moment in time. It contains *snapshots* of current and historical transactions. Thus, you usually do not change the content of existing data in a data warehouse. As time passes, you simply add new data. The data warehouse also contains summarizations of this data.

The databases in a data warehouse usually are quite large. Often, the database is distributed. The data in a **distributed database** exists in many separate locations throughout a network or the Internet. The data is accessible through a single server. The data's location is transparent to the user, who usually is unaware the data is stored in multiple servers.

A smaller version of a data warehouse is the data mart. A **data mart** contains a database that helps a specific group or department make decisions. Marketing and sales departments may have their own separate data marts. Individual groups or departments often extract data from the data warehouse to create their data marts.

Many DSS, EIS, and data mining applications use data warehouses. **Data mining** is the process of finding patterns and relationships among data. A state government could *mine* through data to check if the number of births has a relationship to income level. Many e-commerce sites use data mining to determine customer preferences.

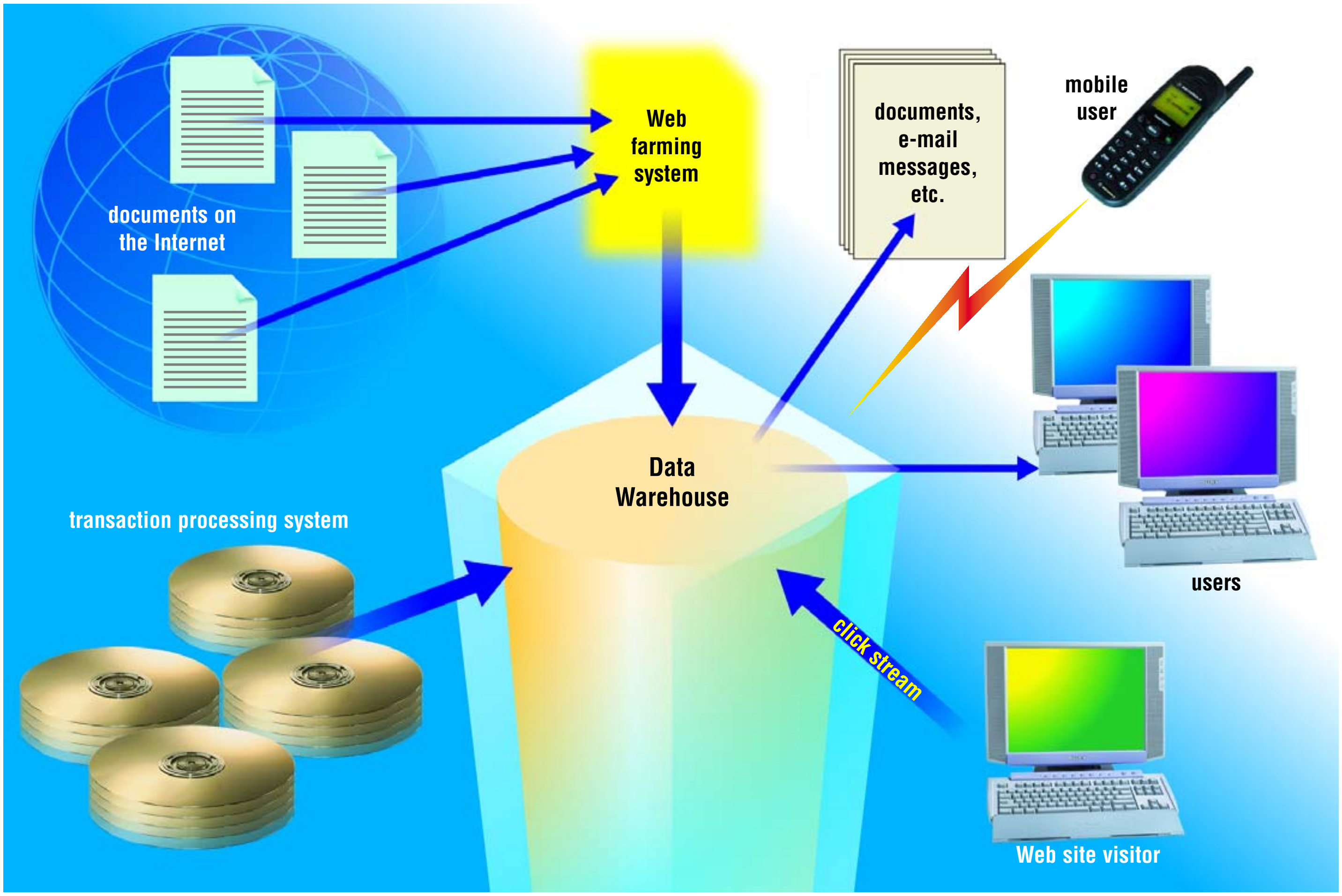

documents on the Internet
Web farming system
documents, e-mail messages, etc.
mobile user
Data Warehouse
transaction processing system
users
click stream
Web site visitor

Figure 13-36 A data warehouse can receive inputs from a variety of sources, including company transactions, the Internet, and Web site visitor click streams.

Expert Systems

An **expert system** captures and stores the knowledge of human experts and then imitates human reasoning and decision making. Figure 13-37 shows how one expert system assists you with purchases of electronics.

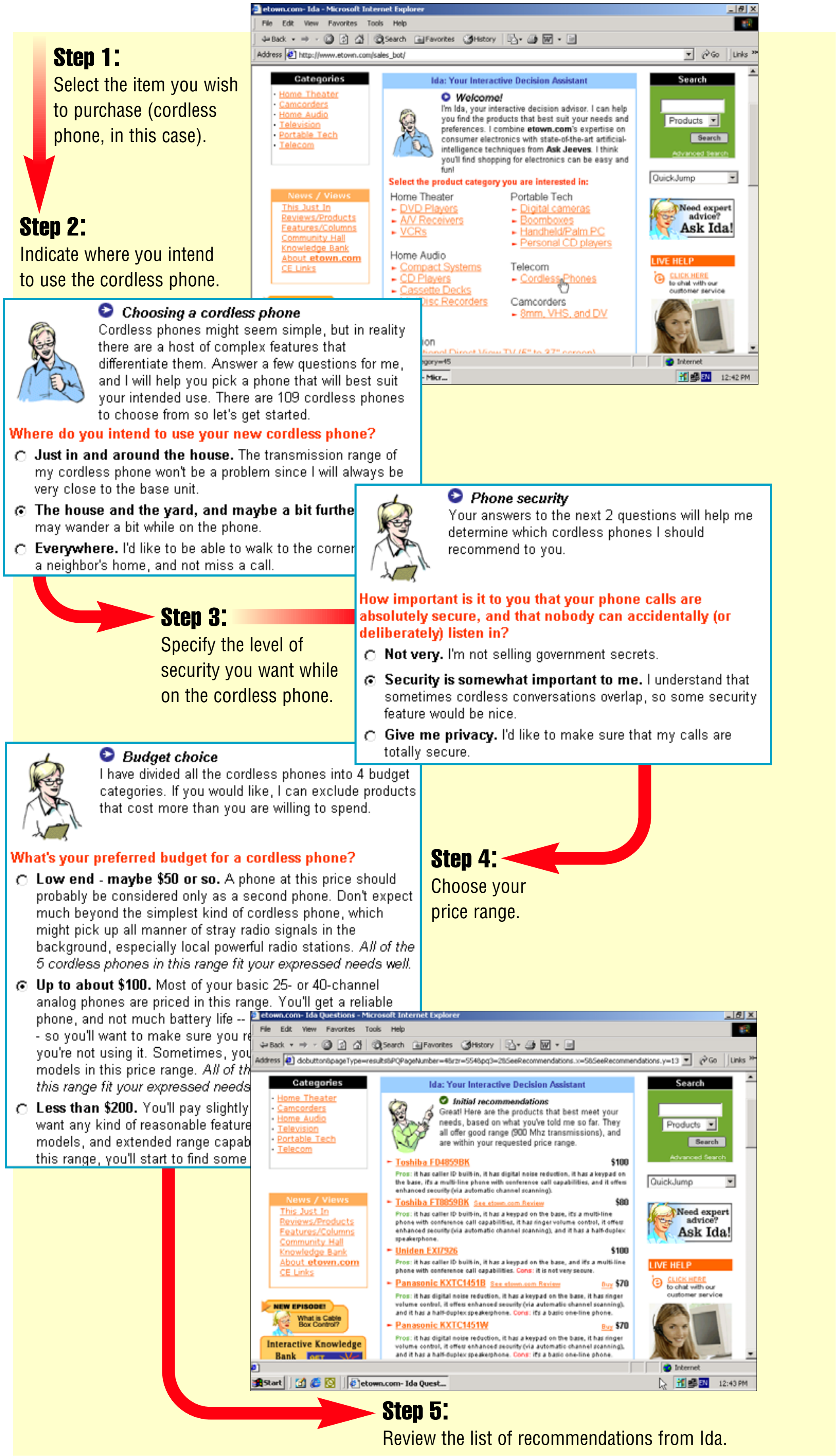
Expert systems consist of two main components: a knowledge base and inference rules. A **knowledge base** is the combined subject knowledge and experiences of the human experts. The **inference rules** are a set of logical judgments that are applied to the knowledge base each time a user describes a situation to the expert system.

Expert systems help all levels of users make decisions. Nonmanagement employees use them to help with job-related decisions. Expert systems also successfully have resolved such diverse problems as diagnosing illnesses, searching for oil, and making soup.

Web Link

For more information on expert systems, visit the Discovering Computers 2002 Chapter 13 WEB LINK page (**scsite.com/dc2002/ch13/weblink.htm**) and click Expert Systems.

Figure 13-37 A SAMPLE EXPERT SYSTEM



Step 1:
Select the item you wish to purchase (cordless phone, in this case).

Ida: Your Interactive Decision Assistant

Welcome!
I'm Ida, your interactive decision advisor. I can help you find the products that best suit your needs and preferences. I combine **etown.com**'s expertise on consumer electronics with state-of-the-art artificial-intelligence techniques from **Ask Jeeves**. I think you'll find shopping for electronics can be easy and fun!

Select the product category you are interested in:

Home Theater
- DVD Players
- A/V Receivers
- VCRs

Home Audio
- Compact Systems
- CD Players
- Cassette Decks

Portable Tech
- Digital cameras
- Boomboxes
- Handheld/Palm PC
- Personal CD players

Telecom
- Cordless Phones

Camcorders
- 8mm, VHS, and DV

Step 2:
Indicate where you intend to use the cordless phone.

Choosing a cordless phone
Cordless phones might seem simple, but in reality there are a host of complex features that differentiate them. Answer a few questions for me, and I will help you pick a phone that will best suit your intended use. There are 109 cordless phones to choose from so let's get started.

Where do you intend to use your new cordless phone?

○ **Just in and around the house.** The transmission range of my cordless phone won't be a problem since I will always be very close to the base unit.

● **The house and the yard, and maybe a bit furthe** may wander a bit while on the phone.

○ **Everywhere.** I'd like to be able to walk to the corner a neighbor's home, and not miss a call.

Step 3:
Specify the level of security you want while on the cordless phone.

Phone security
Your answers to the next 2 questions will help me determine which cordless phones I should recommend to you.

How important is it to you that your phone calls are absolutely secure, and that nobody can accidentally (or deliberately) listen in?

○ **Not very.** I'm not selling government secrets.

● **Security is somewhat important to me.** I understand that sometimes cordless conversations overlap, so some security feature would be nice.

○ **Give me privacy.** I'd like to make sure that my calls are totally secure.

Step 4:
Choose your price range.

Budget choice
I have divided all the cordless phones into 4 budget categories. If you would like, I can exclude products that cost more than you are willing to spend.

What's your preferred budget for a cordless phone?

○ **Low end - maybe $50 or so.** A phone at this price should probably be considered only as a second phone. Don't expect much beyond the simplest kind of cordless phone, which might pick up all manner of stray radio signals in the background, especially local powerful radio stations. *All of the 5 cordless phones in this range fit your expressed needs well.*

● **Up to about $100.** Most of your basic 25- or 40-channel analog phones are priced in this range. You'll get a reliable phone, and not much battery life -- - so you'll want to make sure you re you're not using it. Sometimes, you models in this price range. *All of th this range fit your expressed needs*

○ **Less than $200.** You'll pay slightly want any kind of reasonable feature models, and extended range capab this range, you'll start to find some

Ida: Your Interactive Decision Assistant

Initial recommendations
Great! Here are the products that best meet your needs, based on what you've told me so far. They all offer good range (900 Mhz transmissions), and are within your requested price range.

- Toshiba FD4859BK $100
  Pros: it has caller ID built-in, it has digital noise reduction, it has a keypad on the base, it's a multi-line phone with conference call capabilities, and it offers enhanced security (via automatic channel scanning).
- Toshiba FT8859BK See etown.com Review $80
  Pros: it has caller ID built-in, it has a keypad on the base, it's a multi-line phone with conference call capabilities, it has ringer volume control, it offers enhanced security (via automatic channel scanning), and it has a half-duplex speakerphone.
- Uniden EXI7926 $100
  Pros: it has caller ID built-in, it has a keypad on the base, and it's a multi-line phone with conference call capabilities. Cons: it is not very secure.
- Panasonic KXTC1451B See etown.com Review Buy $70
  Pros: it has digital noise reduction, it has a keypad on the base, it has ringer volume control, it offers enhanced security (via automatic channel scanning), and it has a half-duplex speakerphone. Cons: it's a basic one-line phone.
- Panasonic KXTC1451W Buy $70
  Pros: it has digital noise reduction, it has a keypad on the base, it has ringer volume control, it offers enhanced security (via automatic channel scanning), and it has a half-duplex speakerphone. Cons: it's a basic one-line phone.

Step 5:
Review the list of recommendations from Ida.

Expert systems are one part of an exciting branch of computer science called artificial intelligence. **Artificial intelligence** (**AI**) is the application of human intelligence to computers. AI technology can sense your actions and, based on logical assumptions and prior experience, will take the appropriate action to complete the task. AI has a variety of capabilities, including speech recognition, logical reasoning, and creative responses.

Computer professionals predict that AI features someday will be built into most computers and software applications. Even today, many word processing programs support speech recognition.

Integrated Information Systems

It often is difficult to classify an information system as belonging to only one of the five types just discussed. Much of today's application software supports transaction processing and creates MIS reports. Other applications provide transaction processing, management information, and decision support.

CHAPTER SUMMARY

This chapter reviewed data and information concepts and presented methods for maintaining high-quality data. It then discussed the advantages of organizing data in a database and described various types of databases. You learned about the role of the database analysts and administrators. Finally, the chapter outlined the qualities of valuable information and presented various types of information systems.

Web Link

For more information on artificial intelligence, visit the Discovering Computers 2002 Chapter 13 WEB LINK page (**scsite.com/dc2002/ch13/weblink.htm**) and click Artificial Intelligence.

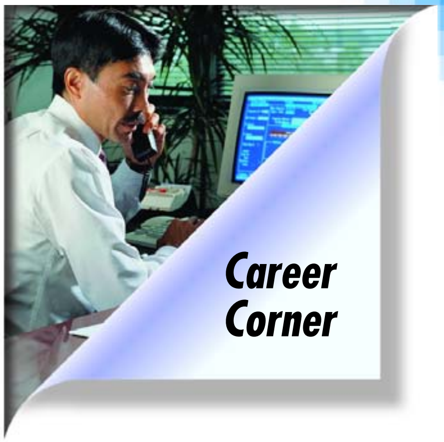
ISSUE

HAL: "Checkmate! I win again."

Computers Imitate Human Thinking

A few years ago, Deep Blue, an IBM supercomputer, defeated world chess champion Gary Kasparov in a chess match. Does this victory mean a computer can think? Does it mean in the next few years computers such as HAL from the movie *2001: A Space Odyssey* will be commonplace? Deep Blue used a type of expert system to win the chess match, which is a branch of artificial intelligence (AI) that uses a knowledge base. Other branches include programming computers to understand natural human languages, robotics, and neural networks. A neural network attempts to imitate the human brain. Which of these branches of AI do you think can be the most beneficial to society? In what way? What are some of the negative aspects? List one or two applications you think would benefit from AI and explain why you think this is so. Will machines eventually have the intelligence to think for themselves?

For more information on artificial intelligence, visit the Discovering Computers 2002 Issues Web page (**scsite.com/dc2002/issues.htm**) and click Chapter 13 Issue #5.



Database Management

An information and database manager is a company's major asset. The majority of businesses and organizations are built around databases. Having access to timely, accurate, and relevant information is the company's lifeline. Individuals who have database skills and can provide this information are in high demand.

A diversity of career opportunities exists within the IT industry. The more common job titles and descriptions within the database field are as follows:

- **Database administrator** administers and controls an organization's resources; works with system administrator and with applications development teams.
- **Database analyst or data modeler** uses data modeling techniques and tools to analyze, tune, and specify data usage within an application area.
- **Data warehousing specialist** develops and designs enterprise-wide applications for data mining (knowledge discovery).

Database jobs require a lot of mental work and the ability to focus on finite details. Being proficient with a database application such as Oracle, Informix, or SQL Server is a plus. The real key, however, is understanding, learning, and becoming an expert in database design.

For more information on database careers, visit the Discovering Computers 2002 Careers Web page (**scsite.com/dc2002/careers.htm**) and click Database Management.

E-HEALTH

NO PAIN

Store Personal Health Records Online

Ouch! You stepped on a rusty nail with your bare foot and made your way to the local hospital's emergency room. The admitting nurse asks when you had your last tetanus shot. You give her a sheepish grin and shrug your shoulders.

HEALTH WEB SITES	URL
WellMed	wellmed.com
IntelliHealth	intellihealth.com
Care Compass Solutions	carecompass.com
MedicalLogic/Medscape	aboutmyhealth.com
PersonalMD	personalmd.com
GlobalMedic	globalmedic.com

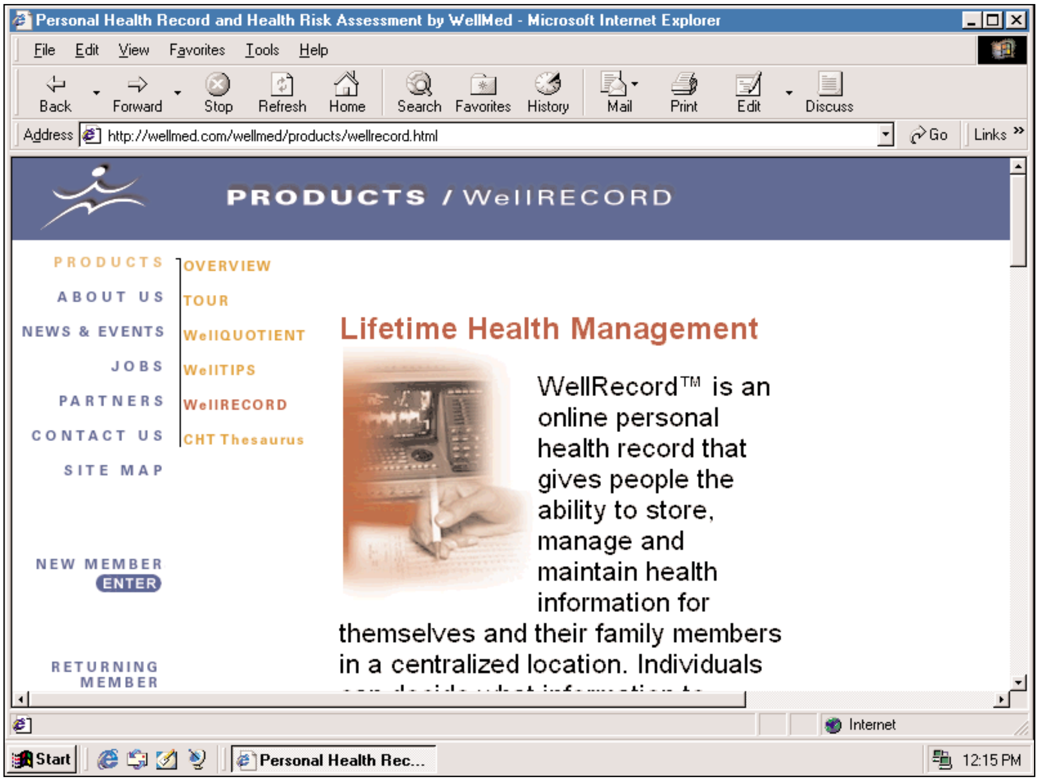
For an updated list of health Web sites, visit scsite.com/dc2002/e-rev.htm.

Figure 13-38 These Internet-based health database management systems Web sites allow you to organize your medical information and store it in an online database.

You might have been able to eliminate the pain and expense of an immunization if you had tracked your shots using an online database management system. Figure 13-38 shows some of the more than 25 Internet health services and portals available online to store your personal health history, including prescriptions, lab test results, doctor visits, allergies, and immunizations. Web sites such as WellMed (Figure 13-39) are free to consumers; revenue is generated in many ways, including charging insurance companies, physicians, and employers who offer this service.

In minutes, you can register with an e-health Web site by choosing a user name and password. Then you create a record to enter your medical history. You also can store data for your emergency contacts, primary care physicians, specialists, blood type, cholesterol levels, blood pressure, and insurance plan.

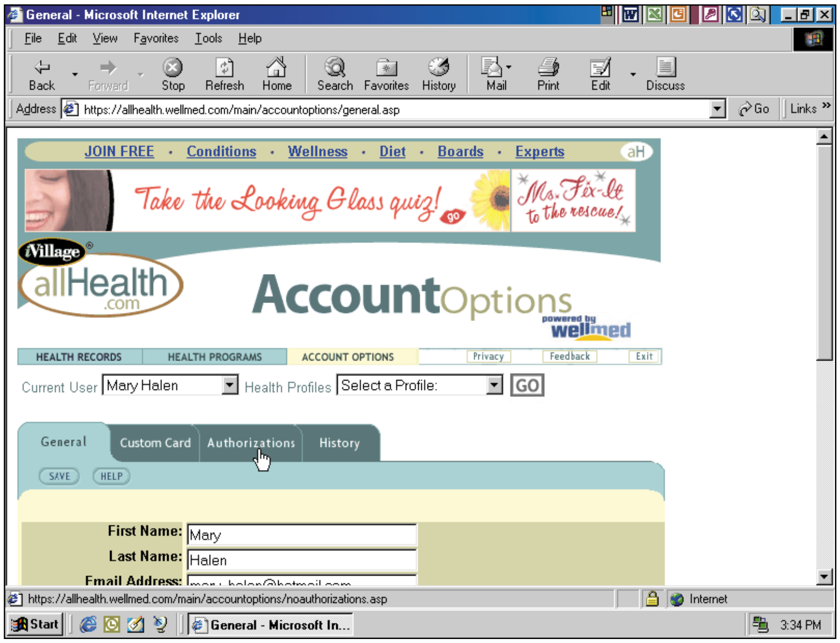
Similar to the records stored in the video database discussed in this chapter, you can access, retrieve, add, change, delete, and use these online records in a variety of ways. You can decide what data to include. You also can determine who



Lifetime Health Management

WellRecord™ is an online personal health record that gives people the ability to store, manage and maintain health information for themselves and their family members in a centralized location. Individuals

Figure 13-39 You can store health records for you and your family in WellMed's database.

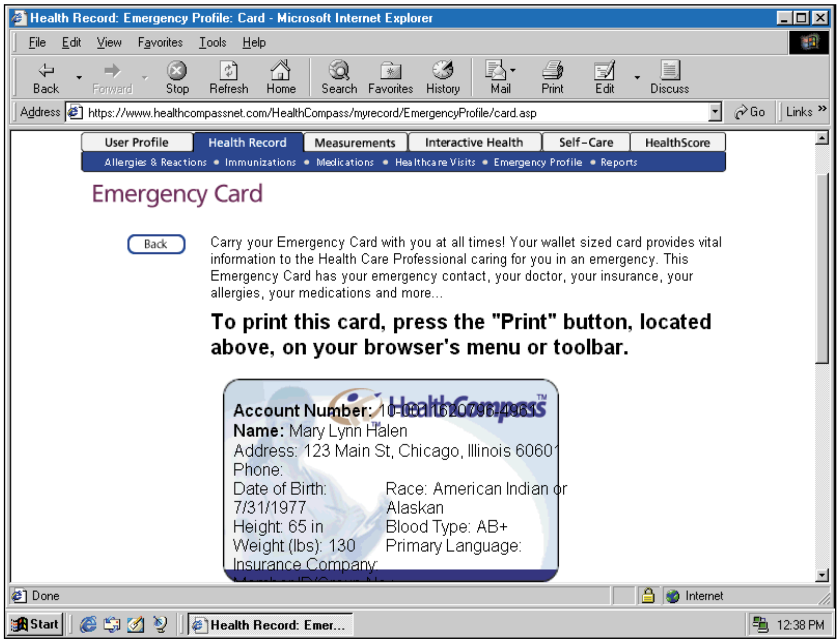

General - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss
Address https://allhealth.wellmed.com/main/accountoptions/general.asp
JOIN FREE • Conditions • Wellness • Diet • Boards • Experts
Take the Looking Glass quiz!
Ms. Fix-It to the rescue!
iVillage allHealth.com
AccountOptions
powered by wellmed
HEALTH RECORDS HEALTH PROGRAMS ACCOUNT OPTIONS Privacy Feedback Exit
Health Profiles Select a Profile: GO
General Custom Card Authorizations History
SAVE HELP
https://allhealth.wellmed.com/main/accountoptions/noauthorizations.asp
Internet
Start General - Microsoft In... 3:34 PM

Current User Mary Halen

First Name: Mary

Last Name: Halen

Figure 13-40 You can authorize physicians and medical personnel to access your health record stored in the allHealth.com database.


Health Record: Emergency Profile: Card - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss
Address https://www.healthcompassnet.com/HealthCompass/myrecord/EmergencyProfile/card.asp
User Profile Health Record Measurements Interactive Health Self-Care HealthScore
Allergies & Reactions • Immunizations • Medications • Healthcare Visits • Emergency Profile • Reports
Back
HealthCompass
Done Internet
Start Health Record: Emer... 12:38 PM

Emergency Card

Carry your Emergency Card with you at all times! Your wallet sized card provides vital information to the Health Care Professional caring for you in an emergency. This Emergency Card has your emergency contact, your doctor, your insurance, your allergies, your medications and more...

To print this card, press the "Print" button, located above, on your browser's menu or toolbar.

Account Number: 10-0011620796-4961
Name: Mary Lynn Halen
Address: 123 Main St, Chicago, Illinois 6060
Phone:
Date of Birth: 7/31/1977
Height: 65 in
Weight (lbs): 130
Race: American Indian or Alaskan
Blood Type: AB+
Primary Language:
Insurance Company:

can access this medical data under specific circumstances. No matter where you are in the world, you and medical personnel can obtain these records via the Internet or fax machine (Figure 13-40). Some Web sites offer an audit log that displays the names of people who have accessed your record and when this action occurred.

Some Web sites issue a wallet-size emergency medical card with instructions for paramedics and other emergency medical personnel on how they can access your vital data (Figure 13-41). Other Web sites can import data directly from pharmacies, hospitals, and physicians' offices.

More than 70-million consumers use the Internet yearly to search for health information, so using the Web to store personal medical data is a natural extension of the Internet's capabilities. Health-care reformers strongly support comprehensive online databases. They explain that using the Internet as a health-history database helps eliminate administrative inefficiencies by automatically transferring data among patients, doctors, and insurance providers. The net results are improved health care overall.

For more information on online health database management systems and for an updated list of health Web sites, visit the Discovering Computers 2002 E-Revolution Web page (scsite.com/dc2002/e-rev.htm) and click Health.

Figure 13-41 In an emergency, a HealthCompass card alerts health-care providers that your medical records are stored online.

e-REVOLUTION E-HEALTH *applied:*

1. Access one of the health Web sites listed in Figure 13-38. Register yourself or a family member, and then enter the full health history. Create an emergency medical card if the site provides the card option. Print this record and emergency card.

2. Visit three of the health Web sites listed in Figure 13-38. Describe the features of each. Which of the three is the most user-friendly? Why? Describe the privacy policies of these three Web sites. Print your analysis of these Web sites.

In Summary

Web Instructions: To display this page from the Web, start your browser and enter the URL scsite.com/dc2002/ch13/summary.htm. Click the links for current and additional information. To listen to an audio version of this In Summary, click the Audio button. To play the audio, RealPlayer must be installed on your computer (download by clicking here).

1 Why Are Data and Information Important to an Organization?

Data is a collection of items such as words, numbers, images, and sounds that are not organized and have little meaning individually. Data is processed into information. **Information** is data that is organized, has meaning, and therefore, is useful. A database is a collection of data organized in a manner that allows access, retrieval, and use of that data. Organizations need data and information to complete many business activities. Information allows a company to make decisions and develop, create, and distribute products and services. Because information is generated with data, an organization must manage, maintain, and protect its data resources.

2 What Are File Maintenance Techniques?

Data is organized in a hierarchy (ranking) in which each higher level is composed of elements from the level preceding it. Different terms describe the various levels. A byte represents a **character**, such as a number, a letter, a punctuation mark, or other symbol. A **field** is a combination of one or more characters and is the smallest unit of data that can be accessed. A **record** is a group of related fields. A **data file**, also called a **file**, is a collection of related records stored on a disk. A database is a group of related data files. Data maintenance refers to procedures used to keep data current. Data maintenance includes adding records, changing records to correct inaccurate data or update older data, deleting records when they no longer are needed, and validating data to determine its accuracy.

3 How Is a File Processing System Different from a Database Approach?

In a file processing system, each department within an organization has its own set of files, designed specifically for their own applications, and the records in one file often are not related to the records in another file. Disadvantages of file processing are data redundancy (duplication of data) and isolated data (data that is difficult to access). A database is a single, shared collection of data used by many application programs in an organization. The **database approach** reduces data redundancy and development time, improves data integrity, facilitates data sharing, and makes reporting easier.

4 What Are the Advantages of Using a Database Management System (DBMS)?

A **database management system** (**DBMS**) is a software program designed to control access to the database and manage data resources efficiently. Database management systems include a data dictionary that stores data about each file, and provides functions such as data maintenance and retrieval, data security, and **backup** and recovery.

5 What Are the Characteristics of Relational and Object-Oriented Databases?

A relational database is based on the relational data model and stores data in tables consisting of rows and columns. A file is referred to as a **relation** or **table**, a record as a **tuple** or **row**, and a field as an **attribute** or **column**. A relational database also stores associations among data, which are called **relationships**. An **object-oriented database** (**OODB**) stores data in objects. An **object** is an item that can contain both data and the activities that read or manipulate the data. Object-oriented databases can store more types of data and access the data faster than relational databases.

6 How Is a Query Language Used?

A **query language** consists of English-like statements used to specify exact data. Structured Query Language (SQL) is used to manipulate and retrieve data in relational databases. SQL includes keywords and rules used to implement **relational algebra** operations. **Object query language**

(**OQL**) is a query language often used to manipulate and retrieve data in object-oriented and object-relational databases. SQL and OQL use many of the same rules, grammar, and vocabulary.

7 How Do Web Databases Work?

Forms are used to access and input data into a Web database. A **Web database** resides on a **database server**. A **CGI** (**Common Gateway Interface**) **script** is a type of program that manages data transmission via the form from the user to the server. Personal computer products, such as Microsoft FrontPage, provide Web publishing tools for smaller databases.

8 What Are the Responsibilities of Database Analysts and Administrators?

The **database analyst** (**DA**) or **data modeler** focuses on the data use. The **database administrator (DBA)** creates and maintains the data dictionary, establishes and monitors database security and database performance, and implements and tests backup and recovery procedures.

9 What Are the Qualities of Valuable Information?

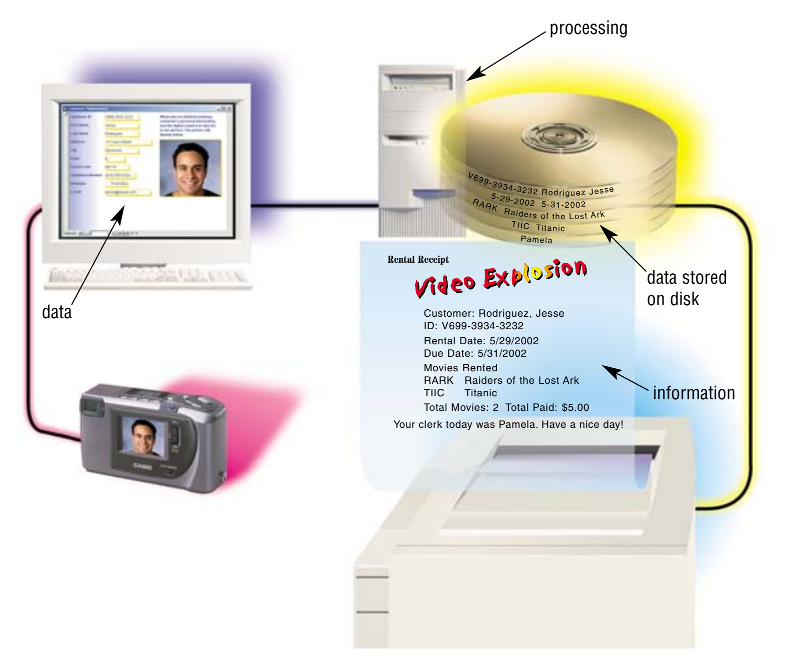
Valuable information is **accurate** (correct), **verifiable** (capable of being confirmed), **timely** (of an age suited to its use), **organized** (arranged to meet user requirements), **useful** (relevant to the person who receives it), **accessible** (available when needed), and **cost-effective** (less expensive to produce than its ultimate value).

10 What Are the Various Types of Information Systems?

An **information system** is a set of hardware, software, data, people, and procedures designed to produce information that supports the activities of users in an organization. An **office information system** (**OIS**) uses hardware, software, and networks to enhance work flow and facilitate communications among employees. A **transaction processing system** (**TPS**) is an information system that captures and processes data from day-to-day business activities. A **management information system (MIS)** generates accurate, timely, and organized information, so managers can make decisions, solve problems, supervise activities, and track progress. A **decision support system** (**DSS**) helps users analyze data and make decisions.

11 What Is a Data Warehouse?

A **data warehouse** stores and manages the data required to analyze historical and current transactions. **Web farming** is the process of collecting data from the Internet as a source for the data warehouse. Many data warehouses use **data mining**, which is the process of finding patterns and relationships among data.



Rental Receipt

Video Explosion

Customer: Rodriguez, Jesse
ID: V699-3934-3232
Rental Date: 5/29/2002
Due Date: 5/31/2002
Movies Rented
RARK Raiders of the Lost Ark
TIIC Titanic
Total Movies: 2 Total Paid: $5.00

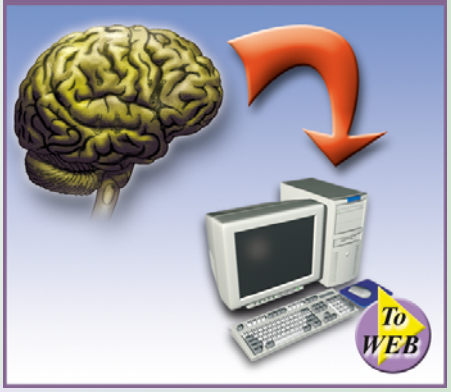
Your clerk today was Pamela. Have a nice day!

Key Terms

Web Instructions: To display this page from the Web, start your browser and enter the URL scsite.com/dc2002/ch13/terms.htm. Scroll through the list of terms. Click a term to display its definition and a picture. Click the To WEB button for current and additional information about the term from the Web. To see animations, Shockwave and Flash Player must be installed on your computer (download by clicking here).

access privileges (13.19)
accessible information (13.31)
accurate information (13.30)
after image (13.20)
alphabetic check (13.9)
artificial intelligence (AI) (13.41)
attribute (13.22)
back end (13.12)
backup (13.20)
backward recovery (13.20)
batch processing (13.35)
before image (13.20)
CGI (common gateway interface) script (13.29)
character (13.4)
check digit (13.10)
click stream (13.39)
column (13.22)
completeness check (13.10)
computer-aided design (CAD) database (13.26)
consistency check (13.9)
controlling (13.32)
cost-effective information (13.31)
data (13.2)
data dictionary (13.14)
data entry form (13.17)
data file (13.5)
data integrity (13.3)
data maintenance (13.6)
data mart (13.39)
data mining (13.39)
data model (13.21)
data modeler (13.30)
data processing (13.35)
data redundancy (13.11)
data type (13.5)
data warehouse (13.38)
database (13.2)
database administrator (DBA) (13.30)
database analyst (DA) (13.30)
database approach (13.12)
database management system (DBMS) (13.14)
database server (13.29)
decision support system (DSS) (13.37)
default value (13.15)
detailed report (13.36)
distributed database (13.39)
e-form (13.18)
electronic form (13.18)
empowering (13.33)
exception criteria (13.37)
exception report (13.37)
executive information system (EIS) (13.38)
executive management (13.32)
expert system (13.40)
external sources (13.37)
field (13.4)
field name (13.4)
field size (13.5)
file (13.5)
file maintenance (13.6)
file processing system (13.11)
form (13.17)
forward recovery (13.20)
front end (13.12)
full-update privileges (13.19)
garbage in, garbage out (GIGO) (13.3)

ARTIFICIAL INTELLIGENCE (AI)
Application of human intelligence to computers. AI technology can sense a user's actions and, based on logical assumptions and prior experience, will take the appropriate action to complete a task. (13.41)



groupware database (13.26)
hypermedia database (13.26)
hypertext database (13.26)
inference rules (13.40)
information (13.2)
information system (13.34)
internal sources (13.37)
isolated data (13.12)
join operation (13.24)
key field (13.5)
knowledge base (13.40)
leading (13.32)
log (13.20)
management information system (MIS) (13.36)
managers (13.32)
metadata (13.15)
middle management (13.33)
MOLAP (13.37)
multidimensional database (MDDB) (13.27)
multimedia database (13.26)
nonmanagement employees (13.33)
normalization (13.22)
numeric check (13.9)
object (13.26)
object query language (OQL) (13.27)
object-oriented database (OODB) (13.26)
object-relational databases (13.21)
office automation (13.34)
office information system (OIS) (13.34)
online analytical processing (OLAP) (13.37)
online transaction processing (OLTP) (13.35)
operational decision (13.33)
operational management (13.33)
organized information (13.30)
organizing (13.32)
planning (13.32)
primary key (13.5)
procedure (13.34)
program files (13.5)
projection operation (13.24)
query (13.15)
query language (13.16)
query-by-example (QBE) (13.17)
range check (13.9)
read-only privileges (13.19)
record (13.5)
recovery utility (13.20)
relation (13.22)
relational algebra (13.24)
relational database (13.22)
relationship (13.22)
report generator (13.19)
report writer (13.19)
repository (13.14)
ROLAP (13.37)
rollback (13.20)
rollforward (13.20)
row (13.22)
selection operation (13.24)
short-range decision (13.33)
strategic decisions (13.32)
Structured Query Language (SQL) (13.25)
summary report (13.36)
table (13.22)
tactical decision (13.33)
timely information (13.30)
transaction processing system (TPS) (13.35)
tuple (13.22)
useful information (13.31)
validation (13.9)
validation rules (13.9)
validity check (13.9)
valuable information (13.30)
verifiable (13.30)
Web database (13.27)
Web farming (13.39)

Learn It Online

Web Instructions: To display this page from the Web, start your browser, and then enter the URL scsite.com/dc2002/ch13/learn.htm.

1. Web Guide

Click Web Guide to display the Guide to World Wide Web Sites and Searching Techniques Web page. Click Reference and then click Webopedia. Search for data dictionary. Click one of the data dictionary links. Use your word processing program to prepare a brief report on your findings and submit your assignment to your instructor.

2. Scavenger Hunt

Click Scavenger Hunt. Print a copy of the Scavenger Hunt page; use this page to write down your answers as you search the Web. Submit your completed page to your instructor.

3. Who Wants to Be a Computer Genius?

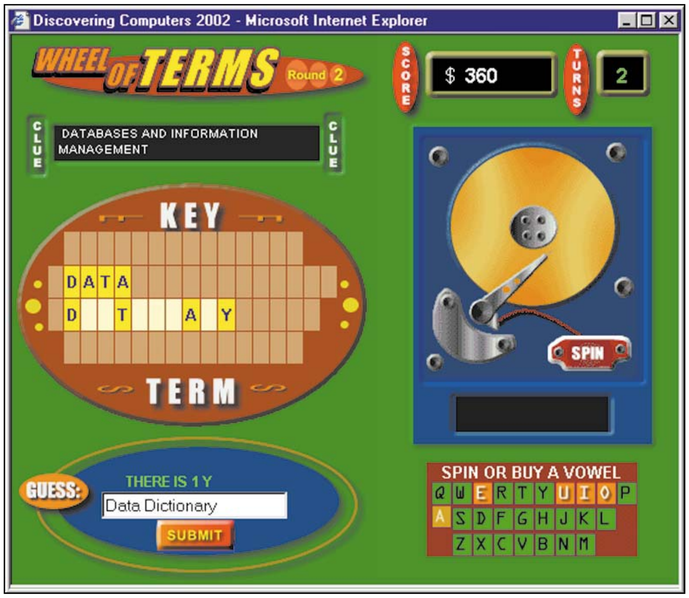
Click Computer Genius to find out if you are a computer genius. Directions on how to play the game will display. When you are ready to play, click the PLAY button. Submit your score to your instructor.

4. Wheel of Terms

Click Wheel of Terms to reinforce important terms you learned in this chapter by playing the Shelly Cashman Series version of this popular game. Directions on how to play the game will display. When you are ready to play, click the PLAY button. Submit your score to your instructor.

5. Career Corner

Click Career Corner to display the JobStarCalifornia page. Click one of the Facts and Information links and then review the information. Write a brief report describing what you learned. Submit the report to your instructor.



Discovering Computers 2002 - Microsoft Internet Explorer

DATABASES AND INFORMATION MANAGEMENT

THERE IS 1 Y

GUESS: Data Dictionary

6. Search Sleuth

Click Search Sleuth to learn search techniques that will help make you a research expert. Submit the completed assignment to your instructor.

7. Crossword Puzzle Challenge

Click Crossword Puzzle Challenge. Complete the puzzle to reinforce skills you learned in this chapter. Directions on how to play the game will display. When you are ready to play, click the PLAY button. Submit the completed puzzle to your instructor.

8. Practice Test

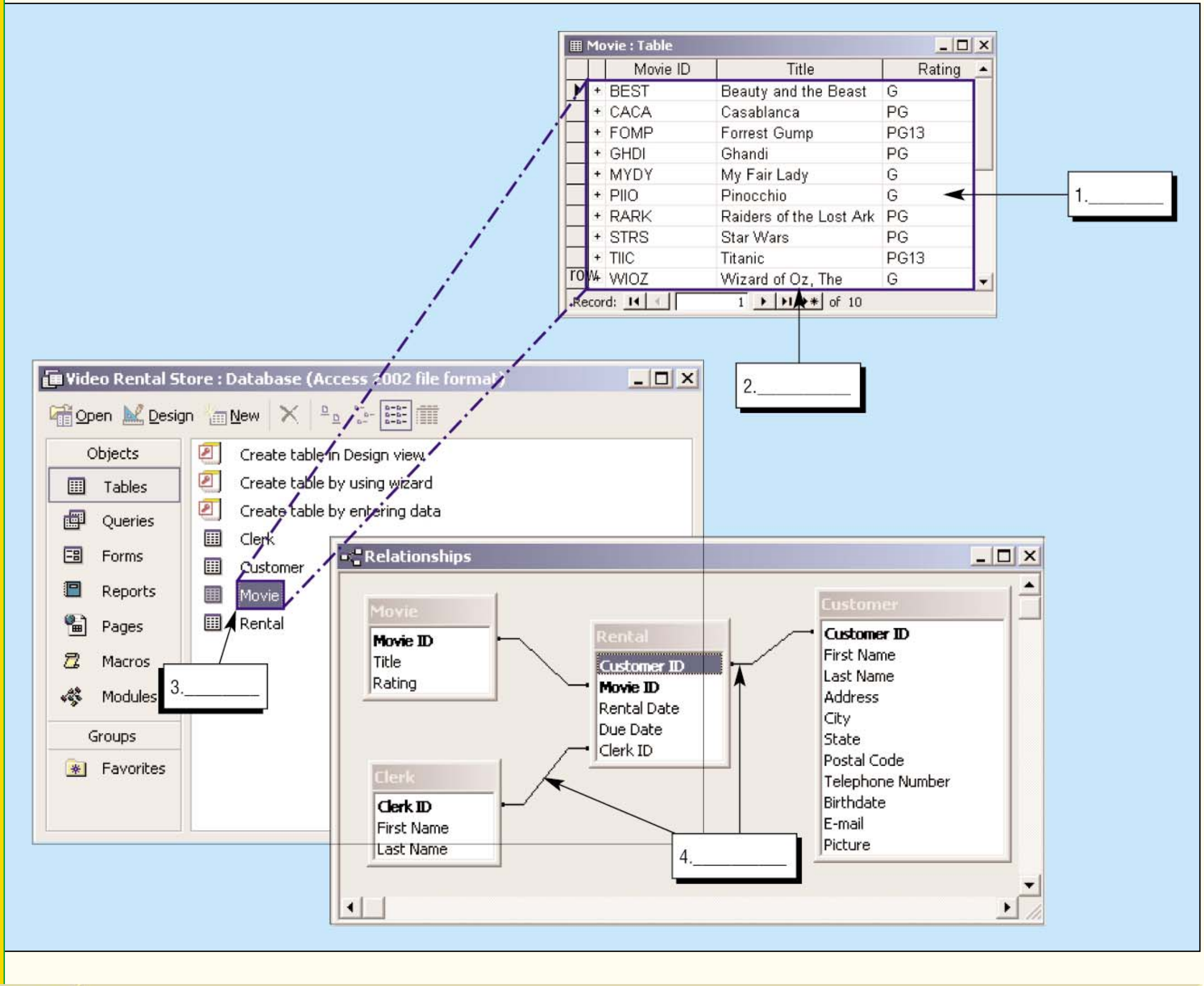
Click Practice Test. Answer each question. When completed, enter your name and click the Grade Test button to submit the quiz for grading. Make a note of any missed questions. If required, print a copy to submit to your instructor.

Checkpoint

Web Instructions: To display this page from the Web, start your browser and enter the URL scsite.com/dc2002/ch13/check.htm. Click the links for current and additional information. To experience the animation and interactivity, Shockwave and Flash Player must be installed on your computer (download by clicking here.)

LABEL THE FIGURE

Instructions: Identify each component of a relational database.



Movie ID	Title	Rating
BEST	Beauty and the Beast	G
CACA	Casablanca	PG
FOMP	Forrest Gump	PG13
GHDI	Ghandi	PG
MYDY	My Fair Lady	G
PIIO	Pinocchio	G
RARK	Raiders of the Lost Ark	PG
STRS	Star Wars	PG
TIIC	Titanic	PG13
WIOZ	Wizard of Oz, The	G

MATCHING

Instructions: Match each term from the column on the left with the best description from the column on the right.

_______ 1. relational database
_______ 2. database approach
_______ 3. validity
_______ 4. data dictionary
_______ 5. query

a. The process of comparing data to a set of rules or values to find out if the data is correct.
b. Verifies the accuracy of a primary key.
c. Many programs and users share the data in the database.
d. Contains data about each file in the database.
e. A value that the DBMS initially displays in a field.
f. A request for specific data from the database.
g. Stores data in tables that consist of rows and columns.

Checkpoint

MULTIPLE CHOICE

Instructions: Select the letter of the correct answer for each of the following questions.

1. A user of a relational database refers to a file as a ___________ .
   a. row
   b. column
   c. table
   d. tuple
2. ___________ is a process designed to make sure the data within the relations (tables) contains the least amount of duplication.
   a. Normalization
   b. Projection
   c. GI
   d. Dimension
3. ___________ is a query language that allows you to manage, update, and retrieve data.
   a. OQL
   b. SQL
   c. MQL
   d. CGI
4. A ___________ database contains text links to other documents.
   a. groupware
   b. multimedia
   c. Web
   d. hypertext
5. ___________ information is information that is correct.
   a. Verifiable
   b. Timely
   c. Accurate
   d. Organized

SHORT ANSWER

Instructions: Write a brief answer to each of the following questions.

1. What is the difference between a file processing system and the database approach? ___________ Which is most widely used in business? ___________
2. What is a data dictionary? ___________ How is it used within a database?___________
3. Why are data integrity and data security important? ___________ What is GIGO? ___________
4. How is a hypertext database different from a Web database? ___________ How is a hypermedia database different from a hypertext database? ___________
5. What is relational algebra? ___________ How are the projection operator, selection operator, and join operator different? ___________

WORKING TOGETHER

Instructions: Working with a group of your classmates, complete the following team exercise.

The ability to create intelligent machines has intrigued humans since ancient times. Many see the computer as the answer and the means to create artificial intelligence (AI). An investigation of AI shows there are several categories within this topic. These include neural networks, artificial life, expert systems, fuzzy logic, natural language processing, and robotics. Select one of these categories to explore. Prepare a report to share with the class. Include within your report information explaining the relationship of AI to databases. To learn more about AI, visit scsite.com/dc2002/ch13/check.htm.

In The Lab

Web Instructions: To display this page from the Web, start your browser and enter the URL scsite.com/dc2002/ch13/lab.htm. Click the links for current and additional information.

Managing Files and Folders

1

This exercise uses Windows 98 procedures. Click the Start button on the taskbar and then click Help on the Start menu. Click the Contents tab. Click the Exploring Your Computer book. Click the Files and Folders book. Click the Managing Files book. Click an appropriate Help topic to answer the following questions:

- How do you create a folder?
- How do you move a file or folder?
- How do you delete a file or folder?

Click the Close button to close the Windows Help window.

Working with Folders

2

Right-click the My Computer icon on the desktop. Click Explore on the shortcut menu to open the Exploring — My Computer window and then maximize it. Click View on the menu bar and then click Large Icons. Insert the Discover Data Disk into drive A. See the inside back cover of this book for instructions for downloading the Discover Data Disk or see your instructor for information on accessing the files required in this book. If necessary, drag the vertical scroll box to the top of the scroll bar in the Folders area. Click 3½ Floppy (A:) in the Folders area to display the contents of drive A. Click File on the menu bar, point to New, and then click Folder on the New submenu. When the new folder displays, type `In The Lab` and then press the ENTER key. Click View on the menu bar, point to Arrange Icons, and then click by Name. Click the plus sign next to 3½ Floppy (A:) in the All Folders area to display the In The Lab folder in the Folders area. Click the In The Lab folder in the Folders area to display its contents. What is in the In The Lab folder?

Click the Close button to close Windows Explorer.

Working with Files in Folders

3

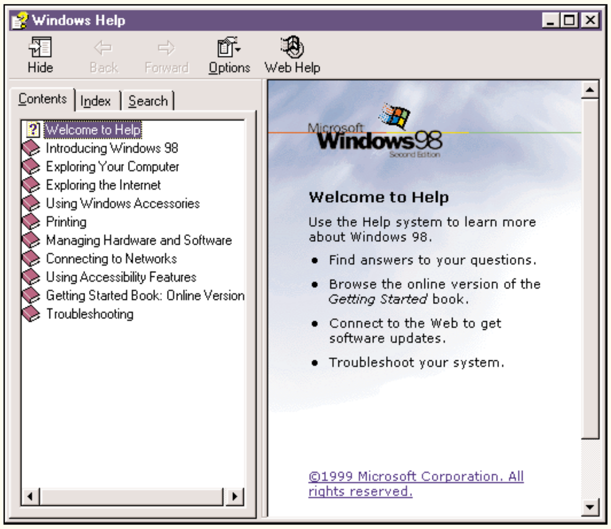
To complete this exercise, you first must complete In The Lab 2 in Chapter 3 on page 3.54. Complete In The Lab 2 above before proceeding with this lab. Open Windows Explorer and then maximize the Exploring — My Computer window. Insert your floppy disk into drive A. Click 3½ Floppy (A:) in the Folders area to display the contents of drive A. Click the plus sign next to 3½ Floppy (A:) in the All Folders area to display the In The Lab folder in the All Folders area. To move the file you created in Chapter 3 (h3-2) into the In The Lab folder, follow the procedure suggested in Help In The Lab or perform the following steps:

- Click the h3-2 icon to select the file.
- Right-drag the h3-2 icon to the In The Lab folder.
- When the In The Lab folder is highlighted, release the right mouse button.

Click Move Here on the shortcut menu. To delete file h7-2 (the copy of file h3-2 that you created in Chapter 7), follow the procedure suggested in Help or perform the following steps:

- Right-click the h7-2 icon.
- Click Delete on the shortcut menu.
- Click the Yes button in the Confirm File Delete dialog box.
- Click the In The Lab folder in the All Folders area. What is in the In The Lab folder?
- Click 3½ Floppy (A:) in the All Folders area. What displays in the window?

Click the Close button to close Windows Explorer.



Welcome to Help
Introducing Windows 98
Exploring Your Computer
Exploring the Internet
Using Windows Accessories
Printing
Managing Hardware and Software
Connecting to Networks
Using Accessibility Features
Getting Started Book: Online Version
Troubleshooting

Welcome to Help

Use the Help system to learn more about Windows 98.

- Find answers to your questions.
- Browse the online version of the *Getting Started* book.
- Connect to the Web to get software updates.
- Troubleshoot your system.

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Web Work

Web Instructions: To display this page from the Web, start your browser and enter the URL scsite.com/dc2002/ch13/web.htm. To view At The Movies in exercise 1, RealPlayer must be installed on your computer (download by clicking here). To use the Shelly Cashman Series Designing a Database Lab from the Web, Shockwave and Flash Player must be installed on your computer (download by clicking here).

ToySmart.Com

ToySmart.Com was an e-tailer of children's toys that went belly up — bankrupt. In its final throes, the company began selling remaining inventory, office furniture, the Web site address itself ... and its customer list. Originally, the company had promised, via notice on its Web site, that it would not share mailing lists and other customer information with other companies. Obviously, information about families, children, and their consumer choices are very valuable assets. Should the company have been allowed to sell these assets to pay off creditors? Would a company have the right to transfer these asset if it were merely acquired by another company, rather than going out of business?

Shelly Cashman Series Designing a Database Lab

Follow the instructions in Web Work 2 on page 1.47 to start and use the Designing a Database Lab. If you are running from the Web, enter the URL, scsite.com/sclabs/menu.htm, or display the Web Work page (see instructions at the top of this page) and then click the button to the left.

Shopping Online

Online shopping is an increasingly prevalent Internet activity. Buying on the Web is especially popular among busy people who are financially secure. During a recent holiday season, a survey found that almost 75 percent of upper-income families made at least one purchase online. Web sites that offer products for sale must provide database search capability as well as online order entry. Click the button to the left and complete this exercise to learn more about database query and order entry in a large online music store.

Newsgroup FAQs

Redundancy in data wastes storage space. Redundant questions demand valuable employee time. Frequently asked questions (FAQs) help reduce the need for experienced newsgroup participants from having to read and answer the same questions more than once. Click the button to the left for a listing of newsgroups with FAQs. Click a newsgroup folder link in which you are interested. Continue clicking folder links until you see a file link called faq.html. Click the faq.html link to see the newsgroup's FAQs. Read the frequently asked questions. What question (or answer) is most surprising to you? Why?

In the News

To spare harried dispatchers, police officers used to request suspect information only when it was urgent. Now, IBM's eNetwork Law Enforcement Express lets officers directly access real-time databases of stolen cars, mug shots, and warrants. With a few taps on a notebook keyboard, police officers can search a database to see if a suspect in custody has a past criminal record. They also can find out if a suspect stopped for speeding is wanted for any more serious infractions. Click the button to the left and read a news article about a database that is being used in a new way. Who is using the database? How is it being used? How will the database benefit the user?